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The A. R. E. A. Program

Morning session, 9:00 a. m. to 12:30 p. m.; afternoon session, 2:00 p. m. to 5:00 p. m.

Today

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Ballast ..... **Bulletin 272**
Buildings ..... **Bulletin 272**
Economics of Railway Location ..... **Bulletin 272**
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Memorial Meeting—Albert W. Johnston, H. T. Douglas, Jr.
Economics of Railway Operation ..... **Bulletin 274**
Yards and Terminals ..... **Bulletin 274**
Special. Stresses in Railroad Track ..... **Bulletin 275**

ANNUAL DINNER 6:30 P. M.

Thursday

Uniform General Contract Forms ..... Bulletin 273
Wooden Bridges and Trestles ..... Bulletin 273
Track ..... Bulletin 273
Signs, Fences and Crossings ..... Bulletin 273
Rail ..... Bulletin 273
Records and Accounts ..... Bulletin 274
Economics of Railway Labor ..... Bulletin 275
Ties ..... Bulletin 275
Co-operative Relations with Universities ..... Bulletin 275
Special. Standardization—Progress Report.
New Business.
Election and Installation of Officers.
Adjournment.

The Program Is Crowded

CROWDED programs for each day's sessions make it difficult to apportion the available time equitably to the various committees. But in large measure, the matter is beyond the control of the presiding officer, for he is governed by the wishes of the convention. As long as the discussion is alive and to the point he is hardly justified in calling a halt. The natural result is that the committees which appear early in the day are accorded ample time, while those that come on toward the tag end of the afternoon have to be satisfied with what little time remains, for experience shows that the discussion lags as the time of closing draws near. This situation has been corrected in some measure by a certain degree of rotation from year to year whereby committees that had an unfavorable place one year get a better chance at succeeding conventions. The crowded program is the most serious problem now confronting the association and deserves serious study.

Signal Committee Fulfills an Obligation

THE report of the Signals and Interlocking committee contained a complete treatment of assigned subjects, including train control. It may be remembered that this committee rather overlooked its opportunity last year by preparing no report on this timely subject of train control but rather chose to refer the members to the Automatic Train Control committee of the American Railway Association for such information. On account of the situation existing at that time between the Interstate Commerce Commission and the carriers on train control matters the committee did not consider that it was advisable to discuss the subject thoroughly at that time. Neverthless, it was the feeling of the members of the A. R. E. A. that there was considerable information on the historical development of train control, questions of clearances and relations to other departments, that should be available in the literature of the association to avoid the necessity of seeking such information from other sources. Whether the severe censure given this committee last year was entirely justified is now aside from the question. The crux of the situation is that this committee took the criticisms in good spirit and has come back this year with a complete, well prepared report giving the members all information desired. For this reason the committee received the thanks of the association on the convention floor, rather a contrast to the action of last year.

What Are the Requirements of a Culvert?

THE assignment of subjects to the various standing committees occasionally gives rise to a conflict of opinion as to which of two or more committees should be the one to study a particular problem. In some cases the reasons leading to this particular de-

cision may not be entirely clear. For example, some may ask why the Committee on Roadway should be assigned the study of certain forms of culvert construction while the Committee on Masonry deals with other phases of culvert design. One answer which may be offered is that certain problems call for knowledge and experience in structural design while others require familarity with the action of an embankment as a whole. Another may be found in the fact that the service rendered by a culvert is not to be measured alone by its strength or its load-carrying capacity as a structure. It involves many other considerations, such as its hydraulic efficiency as a conduit, its facility for adjusting with the settlement of the embankment, the resistance offered to the separation of the several longitudinal sections, etc.

What are the essential requirements of a culvert? How should its effectiveness be measured with respect to the various factors that must enter into the study of any particular type of construction? How can the inspector differentiate in his report between incipient failure and a truly dangerous condition? These and other questions are constantly arising, particularly with respect to some of the newer forms of construction and would seem to open a field of useful service for one or more of the committees in the prosecution of studies leading to the establishment of some sort of standardized requirements.

The Future of Wood Preservation

HAS the science of wood preservation been fully developed? Has it progressed to the point where the technique is thoroughly established and the problems of a scientific character have given way to those of plant operation? These are questions which confront those railways which operate timber treating plants and the commercial timber treating companies alike, although the railways are more vitally interested because of the fact that whether privately or commercially treated the timber goes into their tracks and structures and such economy as is effected accrues to them.

The science of timber preservation has been developed largely as a result of the interest and energy displayed by a few roads which have been willing to pioneer in experimental work, knowing that many of the experiments will undoubtedly fail, but that out of them information will be derived which will point to refinement and improvements in practices which will lead to large ultimate economies. Yet certain tendencies have been evident which lead to the impression that on some roads at least the need for further experimentation has been lost sight of, for specialists of recognized ability in timber preservation have given way to plant operators and development work has been left to an already overburdened engineering staff It is seldom that such men can spare sufficient time from their other duties to do the experimental and investigating work necessary to maintain the progress that has characterized the wood preserving industry in the past. Among the questions which are pressing for solution and on which the committee on Wood Preservation reported yesterday are the use of mixtures of creosote and petroleum and of zinc chloride and petroleum, and the development of the facts regarding the effect of preservation on the inflammability of wood. There is a need for the development of the extent to which maintenance practices can be revised to permit the more extensive framing of timbers before treatment. There is an even greater field for investigation of the possible extension of wood preservation to timber for other uses in railway service. Rather than approaching perfection the technique of wood preservation therefore offers greater opportunities for scientific study than ever before.

Engineering Officers Invited to the Drake

INCREASING the capacity of existing fixed facilities by minimum expenditure is ever a problem for engineering officers who are facing growing traffic. The tonnage hauled per train depends on the size and character of the locomotive and the ruling grade on the division, but the number of trains that can be handled depends on the track capacity, which may be increased by providing additional tracks or in many cases by reducing the spacing between trains by automatic signals.

Chief engineers and others confronted with demands of operating officers for increased track capacity on certain divisions should be interested in the program to be presented on Friday at the convention of the Signal section of the A. R. A. at the Drake hotel, Chicago. The entire day will be devoted to the discussion of the report of the Committee on Economics of Signaling. In this report is an analysis of the cost of an hour of freight train delay on an average division of 125 miles of single track, fixed at $24.98, in which it is shown that by reducing delays 1.25 hours on each trip, a saving of $31.22 is made on each train.

As a part of this report, 20 officers will present papers containing statistics on the use of automatic signals on single and muliple track lines for the movement of trains with or against the normal current of traffic, showing the results being accomplished by existing installations. In addition to the close spacing of trains, these signal installations prevent train stops for orders and in some cases include remote control switch machines which eliminate stops when entering or leaving sidings.

This question of reducing train spacing and preventing train stops depends to a large extent on the location of stations, coaling docks, water tanks and passing sidings, for which the engineering officer is primarily responsible. With this idea in mind, the Signal section has purposely arranged for the special program for Friday, the day following the close of the convention of the American Railway Engineering Association, and is extending an invitation to all members of the latter association to stay over one more day to attend the meeting at the Drake. The signal officers are presenting all the data available on the operation of trains by signal indication and hope to secure the criticism, advice and cooperation of officers who are interested in various means of increasing track capacity.

Among the construction contracts awarded yesterday were one for approximately $200,000 by the Pennsylvania to the Dravo Contracting Company, Pittsburgh, Pa., for the sub-structure of a new bridge across the Beaver river at Beaver Falls, Pa., and a contract by the Boston & Albany with the Palmer Steel Company, Springfield, Mass., for steel work for a new station at Springfield, Mass. The Canadian Pacific plans to extend its Cutknife-Whitford branch line to Edmonton, Alta., and to grade and lay rail for 80 miles along this line from Battle River to a point 25 miles beyond Lloydminster, Alta., this year.

An Early Start

The attention of the members of the American Railway Engineering Association is called to the fact that the convention will be called to order promptly at nine o'clock this morning. In view of the heavy program which is to be presented, it is to be hoped that the members will make a special effort to be present at that hour.

* * *

The Executive committee of the American Wood Preservers' Association will meet at the Old Colony club, Hotel La Salle, at 10 o'clock on Thursday morning.

* * *

H. A. Marshall, formerly water chemist of the Chesapeake & Ohio, has become associated with the Aluminate Sales Corporation, Chicago, in the promotion of aluminate soda for use in water treating.

* * *

The members of the association miss George H. Bremner, who has been treasurer of the organization for several years and has long been one of its most active members. Mr. Bremner suffered a light stroke last summer since which he has been confined to his home a large part of the time. His absence this year breaks a long record for continuous attendance.

* * *

Many members of the American Railway Engineering Association, notably those located in and about Chicago, were shocked to learn today of the death of Professor John Fillmore Hayford, director of the college of engineering at Northwestern University. Professor Hayford had earned a position of unusual distinction during the course of his professional career in connection with his studies of geodesy, conducted primarily while he occupied the position of director of the United States coast and geodetic survey but which he continued since he entered upon educational work at Northwestern University a dozen or more years ago.

* * *

That the addition of more than 16,000 sq. ft. of floor space available for the exhibits at the Coliseum this year was a much needed measure is apparent to even casual observers. The crowd in the main hall during the afternoon of Tuesday equaled or exceeded any previous Tuesday total attendance, while the exhibits in the annexes or additions to the main room held the attention of many visitors at all times during the day. While official figures of attendance are not available at this moment, because of the fact that Secretary C. W. Kelly has had one of his suits pressed during the day, it is estimated that the attendance of Tuesday exceeded by several hundred any previous attendance recorded.

* * *

What the Illinois Central is doing in carrying out its plans for a great passenger station on Roosevelt road between Michigan avenue and the new park development along the lake, and for the electrification of its operations within the city, was the subject of a paper presented by D. J. Brumley, chief engineer, Chicago Terminal Improvements, of that road, to a crowded house at the rooms of the Western Society of Engineers last evening. Among pertinent points brought out in the paper was that the ultimate plan calls for 80 station tracks of a minimum length of 1,200 ft., arranged on three levels, that the total volume of grading will aggregate 10,500,000 cu. yd., and that the electric current for operation of trains will be supplied as 1,500 volts direct current from an overhead conductor.

Members From Japan Attend Convention

Among those attending the convention are three officers of the Japanese Government railways. C. Nakayama, assistant chief engineer, in charge of the Tokio terminal and suburban improvements, has spent over a year studying yards, terminals and track elevation projects in the United States, and in June is going on to London as official representative of the Japanese Government railways at the International Railway Congress. Y. Yamanaka, assistant chief engineer, improvement section of the way and works bureau, in charge of construction, is also in the United States studying methods of construction and maintenance. K. Takata, assistant chief engineer way and works bureau, is making a study of railway maintenance methods and expects to be in the United States until June, 1926. These gentlemen report excellent co-operation from all engineering officers from whom they have requested information.

The Last Call for Dinner

The attendance at the annual dinner in the Gold Room tonight will exceed all records in history of the association. Every available seat on the main floor and in the balcony has been sold and only a few remain in the ante room outside the main entrance. Such keen interest has been aroused in the program that approximately 800 tickets have already been sold. The committee promises that the music, including a chorus of 25 girls and an orchestra of 15 pieces, the speaking and by no means least, the dinner, will be all that is to be desired. Douglas Malloch, well-known humorist, will preside and introduce the speakers (only two)—James C. Davis, director general of railroads and agent of the president, United States Railroad Administration, who has chosen for his subject "The Dawn of a New Day for Railroal Transportation," and Frank H. Alfred, president of the Pere Marquette, who will speak on "The Engineer in the Ascendant."

Why the Editor Left Town

Some time before the Tuesday issue went to press, a representative of the *Railway Age* was advised that certain items had been omitted from the statement of exhibits and representatives of one of the companies participating in its supply show. A correction was prepared and supposedly sent to the printer but a slip occurred somewhere and it did not get in. To make amends for this, attention is called to the following addi-

tions to the statement covering the exhibit of the General Electric Company on page 602 of the Tuesday issue.

Equipment Shown.—Automatic trickle charge generator set, railway volt-ammeter, enameled tube resistors, switch lighting transformers, photographs of substations for signaling and train control and diagrams of rectifiers. Represented by R. D. Amsden, W. H. Arkenburg, W. M. B. Brady, D. L. Cramb, M. M. Hughes, R. L. Hughes, E. E. Kimball, J. J. Liles, W. P. Madden, R. W. Miller, B. S. Pero, L. W. Shugg, A. A. Thompson and H. L. Towne.

More Details Regarding a Photograph in Yesterday's Daily

The picture in yesterday morning's daily edition of the Railway Age showing an engineering party in which C. A. Morse is noted as the third man from the left, was taken at the Maine State College of Agricultural and Mechanic Arts, now the University of Maine, and represented the Civil Engineering section of the class of 1879, this picture being taken in 1878. The later history of those shown in the picture is interesting. The man on the left, M. D. Libby, is an attorney now living at El Reno, Okla. The man next to him is E. J. Blake, who, while chief engineer of the Burlington system, was killed in a railroad accident. The third is C. A. Morse. The fourth is C. W. Gibbs, who is at present superintendent of the Utah Construction Company, Ogden, Utah. The next is F. E. Kidder, now deceased, who was the author of Kidder's Architects' Pocket Book, an architectural reference book that ranks with Troutwine's Engineers' Pocket Book. The next is H. P. Bean, who at one time was in the engineering department of the Milwaukee road, but is now a fruit grower in northern California. The last on the right is G. A. Decrow, who at the time of his death about two years ago, was chief engineer of the Worthington Pump & Machinery Corporation, New York.

Why Exhibitors Jump in the Lake

The manner of controlling admission to the exhibit of the National Railway Appliances Association has been carefully worked out so that railway men are afforded every opportunity to gain admission with the minimum formality while guarding against crowding the Coliseum with people who want to get in for no other reason than curiosity. But apparently an occasional slip-up occurs in these arrangements, as was brought out in an incident related by an exhibitor of railway crossing construction. As he explained it: "We have to assume that the man who stops at the booth is a railroad man and obviously we cannot open the conversation by asking him who he is, so whenever a man manifests an interest in the exhibit we tell him our story." Among others that stopped at this particular booth was a man who studied the exhibit very carefully. He was well dressed and had all the appearances of a man of considerable responsibility and such questions as he asked manifested more than ordinary intelligence. In consequence, there followed a very detailed discussion of the crossings with reference to wheel loads, impact, heat treated bolts, adequate girder strength, etc., which became more involved as the listener continued to manifest interest and apparently understood what was being told him. However, there finally came a pause and the visitor apparently feeling that some comment on his part was called for, offered the following: "That is very interesting. What do you use these things for?"

World Travelers

The representation of Geo. P. Nichols & Bro., at the Coliseum is lacking this year in one respect. "Bro." (otherwise S. F., or, colloquially, Sam), for about the first time in his business life has permitted the work to go along without him while he takes an extended trip through Europe. He has been the member of the firm who has kept his nose to the grindstone and, incidentally, other noses, while George has done the traveling act. Recently Sam was heard from in Seville, Spain, where he has been comparing the cathedral architecture of Seville and perhaps of Burgos and Vallalodid (say Valya-tho-lith, please, if you happen to be reading it aloud), with the architecture of the church in the shadow of whose spire he has so long and so closely dwelt. It took much persuasion on the part of the rest of the firm and of his family to convince him that he could properly absent himself from the details of business for a long trip. But as to the term, "*rest* of the firm," Geo. insists, after an unwonted experience of some weeks with these same details, that "there's no such animal," and later in the year he is going to recuperate his shattered energies by an extended trip on his own account. He has utilized some of the resources of the *Railway Age* in looking up foreign routes of travel.

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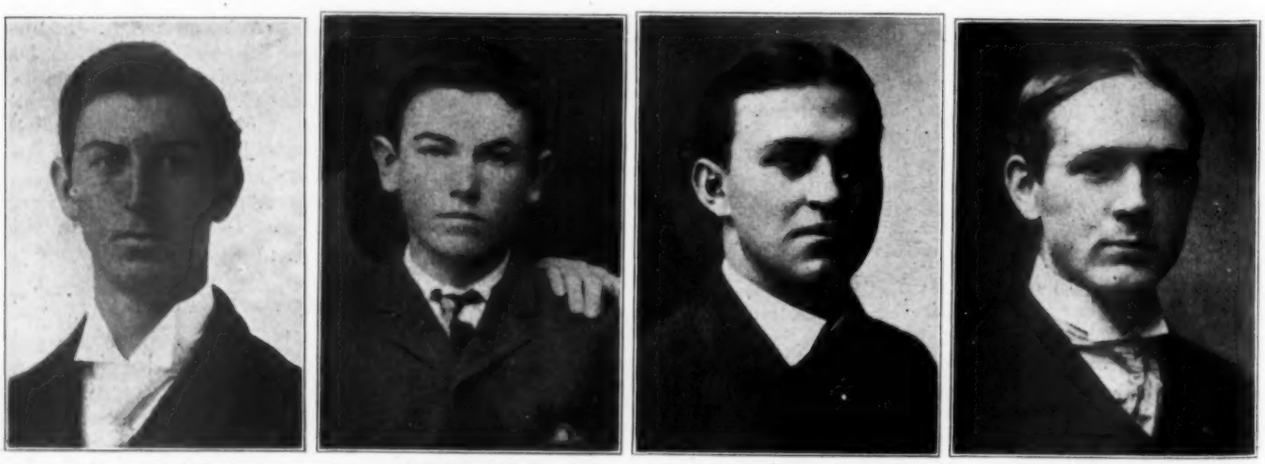


J. M. R. Fairbairn — President Ray — Louis Yager — Earl Stimson

As Some of the Officers of the Association Looked About Thirty Years Ago

The American Railway Engineering Association in Session Yesterday Afternoon

Large Crowds Attend Engineering Convention

Florentine room packed at both morning and afternoon sessions—seven reports presented

THE Florentine room of the Congress hotel was filled to capacity when G. J. Ray, president of the American Railway Engineering Association, called the twenty-sixth annual convention to order shortly after nine o'clock yesterday morning. Mr. Ray reviewed the work of the association during the past year and made a number of constructive suggestions for its future activities, looking particularly toward its closer co-operation with other branches of the American Railway Association and other organizations. After receiving the reports of the secretary and treasurer, the association then proceeded to the consideration of the reports of standing and special committees, including those on wood preservation; shops and locomotive terminals; rules and organization; iron and steel structures; roadway; signals and interlocking and water service.

Address of President George J. Ray

I THINK it is safe to say that the affairs of our association have moved along during the past year in the usual orderly manner, that a reasonable amount of progress has been made and that we are about to enter a new year in a healthy condition.

The past year has been a very satisfactory one from a financial standpoint. The balance on hand at the end of 1924 was in excess of $54,000. It will be the duty of the association to reach a definite decision in the near future as to what use is to be made of these funds. The association might with advantage annually use the interest on these funds to carry on research work. This question should be carefully considered by the board and a recommendation made to the association.

The past year has been a most interesting one in the transportation field. The great airship ZR 3 made a successful trip across the Atlantic from Germany to Lakehurst, N. J. The Shenandoah successfully cruised thousands of miles around the country and army officers started and completed the first round-the-world flight by aeroplane.

Not all of the interesting events for the year in the transportation business was confined to air machines. While the total business handled by the railroads in 1924 was not quite up to the preceding peak year of 1923, the month of October, 1924, was the peak month of all time. This vast tonnage was handled without any material shortage of cars or power in any part of the country.

At the present time the railroads are passing through one of the most interesting stages of their existence. During the past year we have seen some of the first moves toward consolidation under the Transportation Act of 1920.

We will have to help build up some of these new combinations to a point where they are capable of handling the business and to maintain them in an economical manner and safe condition. We will be called upon to adjust the usual construction and maintenance programs to fit the new requirements and conditions.

Recently much has been heard about the application of the budget system to railroads. As practical maintenance men it is our duty to place before our executives a

practical and yet scientific analysis of the requirements of the roads with which we are connected.

The management, in determining the amounts which must be set aside for maintenance, must necessarily depend to a great extent upon the judgment and foresight of the maintenance engineer. The maintenance budget on any given railroad should be based on the requirements as made necessary because of traffic or operating conditions over a period of years and not altered so as to fluctuate with the short swings in traffic. It is a fact that the maintenance requirements fluctuate with the traffic and during long periods when the traffic falls off an appreciable amount, the maintenance forces may be reduced, resulting in a material decrease in expenses without permitting the property to depreciate. Such reductions should never be made without the most careful consideration of all phases of the problem. I contend that even though the wise statistician could predict with reasonable certainty as to the amount of traffic to be expected for a year in advance, it would be a very unwise policy to regulate the maintenance of way requirements to fit the short fluctuations of traffic.

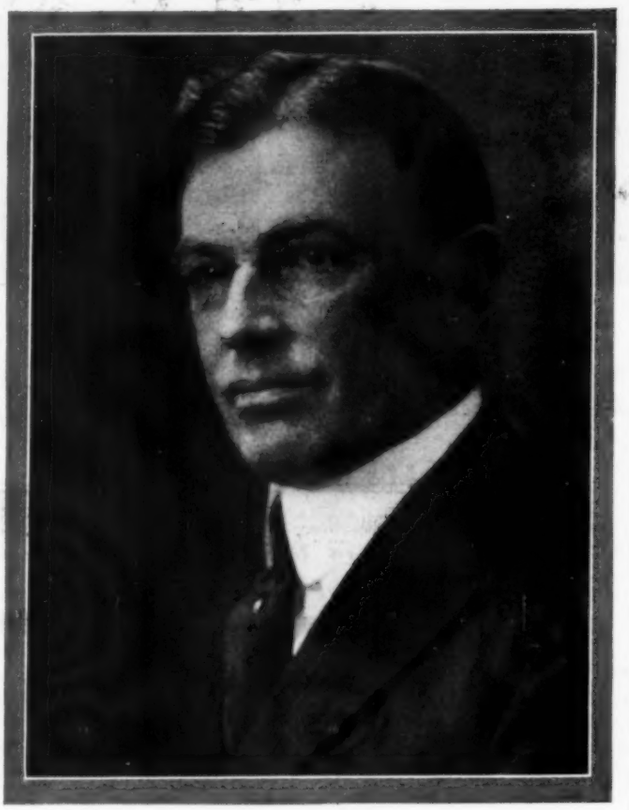
If during the course of 5 or 10 years the business on a given railroad will warrant a certain expenditure for maintenance of way and structures, this expenditure should be made constantly each year. Unless this is done the road will not be efficiently maintained. We know full well that during the months when traffic is the heaviest, assuming that the cost of labor and materials are constant, the cost per unit of materials applied in maintaining the railroad is much greater than during the months of light traffic. Therefore the management that cuts down the maintenance of way expenses at every indication of a falling off of business and again puts on the forces when business picks up is working at a disadvantage and as a result uneconomically maintains the property.

What I desire to do is to convey to you the idea that there should be a reasonable maintenance standard for every individual property. This standard should be based upon the general earning capacity and also upon the kind and class of traffic handled. With this standard correctly fixed, slight fluctuations in the business should not materially alter the yearly program of maintenance work.

It is the duty of maintenance officers to present at all times the issue in the proper light, so that in the end the freight rates as set up for any given district will be sufficient to insure a reasonable return on the money invested and thus provide the necessary funds to maintain the railroads efficiently and properly.

More Interest in Train Control Desired

During the past year the trunk lines have been busily engaged in the installation of various types of automatic train control in order to comply with the recent orders issued by the Interstate Commerce Commission.



George J. Ray
President

Out of the large membership of the American Railway Engineering Association there are few who have had a greater interest in its welfare or who have taken a more active part in the association's work. He has contributed much valuable assistance in the conduct of a number of committees through membership or as a chairman or vice-chairman. They include the Committees on Track, Rail, Standardization, Stresses in Track and Co-operative Relations with Universities. As chief engineer of the Delaware, Lackawanna & Western, Mr. Ray has had unusual opportunities to further the practical science of engineering.

Regardless of our position and whether or not we now are or ever have been interested in signal, interlocking or train control work, we cannot afford to disregard this all-important subject. All of the mechanical geniuses and automatic train control inventors in the world cannot make a success of automatic train control without the assistance and co-operation of the men who are close to the construction, maintenance and operation of our roads.

We must not overlook the fact that our help is needed whether or not we are signal men or whether our duties require us to consider any phase of train control installation or maintenance. As members of the American Railway Engineering Association it is your duty to familiarize yourself with train control work and earnestly endeavor to acquire a working knowledge of what is going on in this most important field.

It is quite probable that none of us have any real doubt but that train control will be worked out in a reasonably satisfactory manner. We have not been much surprised at the seeming delay in the completion of the first installations of the various devices now being installed. The path of progress is strewn with many difficulties and perplexing problems. Only those blinded by the screen of their own ingenuity, as inventors, or irresponsible promoters have failed to see the proportions of this great problem.

I desire at this time to call your attention to the very valuable report of the Signal Committee. This committee has put into concise shape for our use very valuable data on the two subjects of automatic train control and signals for highway crossing protection.

Co-operation With Signal Section Urged

We should have more signal men on many of our committees and we should have more members who are not signal men on the signal committee. It is unfortunate that the first day of the Signal section meeting conflicts with the last day of our meeting for we need the signal men and we also believe that they need us.

To be valuable signal men it is absolutely essential that they have sufficient knowledge of the engineering, maintenance and operating problems to insure recommendations on their own part that will be in keeping with good railroad practice. In my opinion there is no better place to start the accumulation of this knowledge than in the committee work of our Association.

It is generally the duty of the signal engineer to convince the engineering and operating officers that this or that improvement, type of signal, automatic crossing protection or interlocking plant should be used. He cannot expect to be successful unless he familiarizes himself with other branches of the service than his own particular line. I believe that the signal men who are members of our Association will agree that it is their duty to convince all of the younger men of the Signal section that they should also become members of the American Railway Engineering Association and take an active part in the affairs of this Association.

I also desire to take this opportunity to suggest to the members of this Association that you will find it well worth your while to stay over until Friday and attend the meeting of the Signal section on that day.

Some weeks ago I was surprised on reading a press statement purporting to be an interview with the president of one of the motor car companies who suggested that "If the railways would devote a fraction of the money to the improvement of their own methods of operation and especially to grade separation that they now spend in retaining lawyers and in court costs to contest damage suits, to repair and replace equipment destroyed in collisions, they would accomplish something beneficial to humanity and of permanent value to themselves." He further stated that "Sooner or later aroused public indignation will force the separation of all grades either by depressing the railroads or elevating them." The *Railway Age* commented upon this statement in a very effective way in an editorial on February 7. His statements were so absurd that it should not be necessary to give them a moment's consideration. At the same time we must not overlook the fact that such statements sent broadcast through the land in the daily press are bound to do untold harm and if let go unnoticed would in the end bring about legislation that would cost the railroads and the public at large fabulous and unwarranted expenditures.

Most of us are in favor of the speedy elimination of all of the more important grade crossings, but on account of the enormous cost of the work this matter must necessarily be approached with reason and good judgment.

State or County funds, largely collected by taxation from the railroads and other industries, should never be used for major improvements on existing through highways or for the construction of new ones where the railroad grade crossings on such highways are to be left at grade. Such crossings should be eliminated and a large part of the cost paid out of the taxes collected from the railroads. It is my understanding that in connection with the Federal Highway Act of 1921, providing for Federal aid on certain state roads, the Federal authorities will not approve of plans where railroad crossings are to be left at grade. This is a move in the right direction, and similar restrictions should safeguard the State and County funds.

It would be much better to restrict the amount of road building and utilize some of the taxes collected from the railroads and the public at large for making safer the good roads we now have and such new ones as we can afford to build.

An Organization for Grade Crossing Elimination

Again, many grade crossings can be eliminated where roads cross and recross the tracks by the construction of new highways paralleling the railroad, or through combining two or more roads to eliminate one crossing, and also by providing over or undercrossings at points where roads can be changed and the work done within a reasonable expenditure. Some organized movement should be started with a view of convincing the various public bodies that a co-operative movement between the railroads and the authorities will go a long way toward eliminating grade crossings and at the same time save all concerned unnecessary expenditures. There is probably no organization in the country better suited to undertake such a movement than the American Railway Engineering Association. The members of this Association are responsible for the maintenance of the tracks of practically all of the railroads of the country and it would seem feasible to make a reconnoissance survey of the entire country in one season which would place on record every possible location where a highway crossing could be eliminated, within reasonable costs, by the diversion of the road. Such a survey should not be confined to the observation of the railroad officials, but should be a co-operative one with public authorities.

Committees Should Work Throughout Year

The officers of your Association made a special request on the committee chairmen late last fall that an earnest effort be made on the part of committees to carry along their work during the winter months. The development of this subject has brought out the fact that some committees do carry on their work actively during the winter months, while others have been inclined to drop active committee work between the date that the annual report is submitted to the secretary and the time in the spring when the revised personnel of committees is sent out to the membership.

As a rule, each committee has under consideration several subjects on which no definite report can be made at the annual convention. With such subjects and also with subjects where progress reports are made, there would seem to be no good reason why the committees should not actively continue their work during the winter months. The three months from December to February, inclusive, are the best months in the year in which to get good attendances of both the main committee and sub-committees. Again, some of the most effective work can probably be done immediately after the convention when the discussions at the annual meeting are fresh in the minds of all concerned.

I wish to suggest in conclusion:

(1), That every possible effort be made to co-operate with all other branches of the American Railway Association and also with outside societies where

such co-operation will benefit our Association, the roads or the public;

(2), That great care be used in the arrangement of the program of both the American Railway Engineering Association and the Signal section of the American Railway Association; that correlated subjects under discussion be set for days when all interested can attend the meetings; and that so far as possible, committee reports, in which the members of the Signal section are interested, should be given on the first and second days of the convention so as to enable the signal men to attend and give us the benefit of their presence.

(3), That the practice be continued of holding a meeting of the committee chairmen with the Outline of Work Committee immediately after the convention and all committee chairmen urged to attend this meeting.

(4), That the Board of Direction give careful consideration to the best possible use to be made of the association's accumulating funds.

(5), That each committee chairman carefully lay out the work of the committee with a view of avoiding a period of inactivity during the winter months and immediately following the March convention.

(6), That the members be urged to give the Association the benefit of specially prepared papers on subjects of vital interest to our Association.

Report of the Secretary

THE ACTIVITIES OF the respective committees in the past year have been directed in the following proportions:

On roadway and track problems	30 per cent
On structure problems	24 per cent
On railway economics	5 per cent
On operating problems	16 per cent
On railway labor problems	6 per cent
On miscellaneous engineering problems	19 per cent

Research Work

The most notable research work undertaken by the Association in recent years is that being conducted by the Committee on Stresses in Railroad Track, under the able direction of Prof. A. N. Talbot, of the University of Illinois. The results of this exhaustive study of the stresses in railroad track have been made available in four voluminous progress reports. This work has created world-wide attention among scientific men. The first three progress reports have been abstracted and translated into the Czecho-Slovakian language by Prof. Ing. Josef Kugler, of the University of Prague, and published in the "Technical Review" of that country.

Progressive motive power officers are following closely the results of the tests made by the committee. As an indication of improvements made by changes in the design of locomotives, after track tests had been made, whereby a critical excessive stress developed in the rail of a ten-degree curve was decreased by one-third, is described in a paper by C. T. Ripley, chief mechanical engineer of the Atchison, Topeka & Santa Fe, entitled "The Relation of Track Stresses to Locomotive Design." That monograph brings out clearly the intimate relation between locomotive design and the stresses in track.

During the coming year the Roadway Committee expects to inaugurate a series of tests on culvert pipe, in co-operation with the Armco Culvert and Flume Manufacturers' Association. The Committee on Iron and Steel Structures plans to make tests on the behavior of bridge pins, the experiments to be made in the laboratory of Lafayette College. This committee is also preparing to make tests on the bearing values of large rollers at the University of Illinois.

Committees

The standing and special committees of the association, number of members of which they are composed and the meetings held during the year, and attendance are as follows:

Standing Committees	No. Members	No. Meetings	Attendance
Roadway	26	3	22
Ballast	26	2	11
Ties	28	2	33
Rail	23	5	82
Track	33	3	62
Buildings	23	2	20
Wooden Bridges and Trestles	23	2	25
Masonry	21	3	34
Signs, Fences and Crossings	25	3	32
Signals and Interlocking	19	6	77
Records and Accounts	25	5	58
Rules and Organization	24	3	24
Water Service	32	5	106
Yards and Terminals	32	3	47
Iron and Steel Structures	34	5	83
Economics of Railway Location	19	1	4
Wood Preservation	24	3	33
Electricity	22	3	45
Uniform General Contract Forms	21	2	27
Economics of Railway Operation	33	3	50
Economics of Railway Labor	24	3	40
Shops and Locomotive Terminals	27	3	36
Co-operative Relations with Universities	16	2	13
Special Committees			
Stresses in Railroad Track	20	2	23
Standardization	25	none	none
Clearances	12	none	none

Approximately one-third of the membership of the association participated in committee work during the year.

Report of Membership

Membership as of March 1, 1924		2,149
Additions during the year	163	
Losses by death during the year	21	
Resignations	29	
Dropped from rolls	35	
Net gain in membership	78	78
Total membership		2,227

Deceased

J. C. Auten, principal assistant engineer, Pennsylvania System; W. A. Brewer, assistant engineer, Chicago & Northwestern; A. B. Corthell, chief engineer, Boston & Maine; A. E. Deal, bridge engineer, Delaware, Lackawanna & Western; H. T. Douglas Jr. (director), chief engineer, Chicago & Alton; J. M. Egan vice-president and general manager, Missouri Pacific; Edward Ford, assistant to president, Alabama & Vicksburg; J. L. Harper, vice-president and chief engineer, Niagara Falls Power Company; Albert W. Johnston (past president), formerly general manager, New York, Chicago & St. Louis; D. P. Kazakevitch, civil engineer; G. F. Konold, civil engineer; C. F. Koppisch, civil engineer; H. C. Lothholtz, formerly engineer of design, Chicago, Milwaukee & St. Paul; L. M. Perkins, executive assistant, Northern Pacific; C. C. Post, assistant engineer, Union Pacific; J. M. Rapelje, vice-qresident—operation, Northern Pacific; B. F. Sedwick, assistant engineer, adjustment division, Baltimore & Ohio; A. C. Stickney, division engineer, Boston & Maine; D. A. Tomlinson, manager railways bureau, Portland Cement Association; W. T. Tyler, formerly director of operation, U. S. Railroad Administration and F. H. Watts, engineer maintenance of way, Pennsylvania System.

The original charter membership list consisted of three hundred names. Of that number, 82 still retain membership. The losses through death were 178, while 40 withdrew from membership on account of retirement from active railway service or to engage in other pursuits.

Classification of Membership

The following table is a departmental classification of the membership:

General Officers—Includes Chairmen of Boards, Presidents, Directors, Vice-Presidents, Assistants to Presidents, General Managers, Assistant General Managers 132

Conducting Transportation—Includes General and As-

sistant General Superintendents, Division Superintendents, Trainmasters	87
Maintenance of Way and Structures—Includes Chief Engineers, Chief Engineers of Maintenance of Way, Engineers Maintenance of Way, Bridge Engineers, Division Engineers, Signal Engineers, Assistant Engineers, etc.	1,520
Maintenance of Equipment—Includes General Superintendents of Motive Power and other Mechanical Department Officers	18
Traffic Officers	4
Accounting Officers	7
Purchases and Stores Department	2
Professors in Colleges	53
Miscellaneous—Includes Consulting and Civil Engineers, Engineers of Industrial Corporations, Government and Municipal Engineers, etc.	404
Total	2,227

The demand for the publications of the Association is constantly increasing, more particularly from manufacturers of railroad appliances and supplies, indicating a more extensive use by railway companies of the specifications, plans and designs of the Association.

E. H. FRITCH, Secretary.

EXHIBIT G

FINANCIAL STATEMENT FOR CALENDAR YEAR ENDING DECEMBER 31, 1924

Balance on hand January 1, 1924	$44,226.38

RECEIPTS

Membership Account	
Entrance Fees	$ 2,710.00
Dues	21,891.00
Binding Proceedings and Manual	1,533.00
Badges	15.00
Sale of Publications	
Proceedings	3,801.13
Bulletins	2,159.40
Manual	3,503.14
Specifications	917.20
Leaflets	246.00
Advertising	
Publications	2,352.80
Interest Account	
Investments	1,801.25
Bank Balance	200.71
Annual Meeting	3,110.00
Miscellaneous	27.95
American Railway Association	
Rail Investigations	11,469.90
Total	$55,738.48

DISBURSEMENTS

Salaries	$ 8,964.92
Proceedings	4,650.74
Bulletins	12,874.15
Manual	200.00
Stationery and Printing	1,322.69
Rents, Light, etc.	845.00
Supplies	330.05
Expressage	646.31
Postage	1,340.40
Exchange	94.30
Committee Expenses	97.50
Officers' Expenses	51.62
Annual Meeting	4,445.13
Refund Dues, etc.	56.00
Audit	150.00
Miscellaneous	207.77
American Railway Assn.—Rail Investigations	9,257.22
Total	$45,533.80
Excess of Receipts over Disbursements	$10,204.68

Report of Committee on Roadway

The Committee on Roadway submitted proposed changes in certain rules laid down under the caption of "General Conditions" in specifications for the formation of the roadway, the underlying thought being to separate the functions of the specifications from the contract. It re-submitted its recommendations on the economics of filling bridges, as presented to the 1924 convention. It presented as information reports on corrugated metal culverts, unusual methods of handling problems in connection with slips, slides and water pockets, methods of keeping down dust, considering road crossings and platforms as well as track, and methods of waterway, channel and bank protection. C. M. McVay has served as chairman for 3 years and has been a member of the committee for 10 years.

C. M. McVay
Chairman

THE COMMITTEE presented a report covering the (1 & 4):—Revision of Manual; revision of the Grading Contract, working with the Committee on Uniform General Contract Forms (Appendix A), (2) Economics of filling bridges (Appendix B), (3) Corrugated metal culverts for railroad purposes (Appendix C), (5) Unusual methods of handling slips and slides (Appendix D), (6) Methods of keeping down dust (Appendix E), and (7) Waterways, channels and bank protection (Appendix F). The action recommended by the committee was that the change in the Manual, Appendix A, be approved and the revised version substituted for the present recommendation in the Manual: that Appendix B be approved as recommended practice and published in the Manual; and that Appendices C, D, E and F be received as information.

Committee: C. M. McVay (N. Y. C.), Chairman; J. C. Wrenshall (Reading), Vice Chairman; C. W. Baldridge (A. .T. & S. F.), H. B. Barry (St. L.-S. F.), E. J. Bayer (C. C. C. & St. L.), A. E. Botts (C. & O.), G. S. Crites (B. & O.), C. C. Cunningham (C. R. I. & P.), C. A. Daley, A. Harvey (M.-K.-T.), C. F. Hinchman (C. C. C. & St. L.), J. R. Hoagland (C. & A.), H. M. Hockman (T. St. L. & W.), W. M. Jaekle (S. P.), W. W. Kelly (A. T. & S. F.), E. C. Oyler (Penna.), O. V. Parsons (N. & W.), J. K. Pettus (N. S.), G. E. Potter (N. Y. C. & St. L.), H. J. Shaw (Penna.), G. L. Sitton (Sou.), E. M. Smith (B. & M.), H. E. Tyrrell (Sou.), C. E. Weaver (C. of Ga.), W. D. Wiggins (Penna.), W. H. Woodbury (D. & I. R.)

Appendix A—Revision of Manual

The committee felt that certain rules laid down under "General Conditions" should be omitted entirely because they are already more properly placed and described under the "Construction Contract," the underlying thought being to separate the functions of the specifications from the contract; the former should constitute the instructions as to how the work should be done, the latter covering the agreements as to its performance.

Revision of several of the articles was suggested as follows:

Present Form
Temporary Fences

69. Previous to or during the work of grading, the contractor, if desired, shall erect and maintain fences in order to prevent trespass upon the railway or damage to adjoining property.

Crossings, Damage to Property

70. The contractor shall, at his own expense, make and keep in good condition commodious passing places for public and private roads traversed by the line of railway; and he shall be held responsible for damages of whatsoever nature to persons or neighboring property caused by workmen in his employ leaving gates or fences open, blasting rock, building fires or in other ways. If necessary, the payment of the estimate may be withheld until such damages are satisfactorily adjusted. The intention of the contract is that the company shall not be held responsible for any claims or losses incurred during the construction of the line due to the operation or negligence of the contractor or his employes.

Proposed Form

Previous to or during the work of grading, suitable temporary fences shall be erected and maintained, if necessary, in order to prevent trespass upon the railway or damage to adjoining property.

Suitable roads for public and private use shall be provided and maintained as may be necessary within the limits of the work. All other necessary special facilities shall be provided.

Present Form

Changes of Alinements or Gradients

71. The alinement, gradients and cross-sections of the roadbed, as well as ditches and other incidental work, be altered in whole or in part, as deemed necessary, either before or after the commencement of the work. But any such change or alteration shall not affect the unit prices specified in the contract; nor shall any such changes or alterations constitute claims for damages, nor shall any claim be made or allowed on account of such changes or alterations.

Snow and Ice

72. Before beginning and during the progress of the work, the contractor shall remove all snow and ice from between the slope stakes at his own expense.

Bench Marks and Stakes

73. The contractor shall carefully preserve all bench marks and stakes. In case of neglect to do so, he will be charged with the resulting expense.

Roads

74. Whenever required, the contractor shall open up a safe road for passage on horseback and foot along the whole or any portion of the work under contract.

Temporary Roads, Trestles, etc.

75. No allowance or compensation whatsoever shall be due or paid to the contractor for any temporary roads, bridges or trestles that he may make to facilitate the work.

Final Clearing Up

76. Before the work is finally accepted, the contractor shall, at his own expense, clear away from the company's property as well as from public and private roads and the channels of streams and ditches, all rubbish, surplus blasted or excavated material, camp and work equipment.

Extra Work

77. The cost of any extra work shall not be considered or allowed, unless such extra work shall have been done by direction, in writing. Such written directions shall in every case contain the rates and methods of payment for said extra work.

Proposed Form

Omit—conflicts with paragraph 8, page 962.

Snow and ice shall be removed when necessary before placing grading material.

Omit—conflicts with paragraph 11, page 959.

Omit—conflicts with paragraph 5, page 958.

Such temporary roads, bridges, or trestles as may be necessary to facilitate the work shall be provided.

Omit—conflicts with paragraph 23, page 961.

Omit—conflicts with paragraph 29, page 962.

Present Form
Contractor's Risk

78. The contractor shall take all risks from casualties of every nature, and shall not be entitled to any compensation for detention from such causes. The contractor assumes risk of personal liability and damage to stock, tools and machinery used on the work while on the property of the railway company, and the contractor agrees to make no claim therefor which may be caused by the operation of the railway.

Company Defined

79. Wherever the word "Company" is used in these specifications it designates the ..... Company.

Contractor Defined

80. The word "Contractor" is used herein to designate the person or persons undertaking the work referred to in these specifications and drawings.

Work in Charge of

81. In the foregoing specifications it is understood and agreed that the Chief Engineer of the ..... Company is in charge of the work, and that he may appoint such assistants as he may select. Wherever the specifications refer to the judgment, direction, decision, approval, etc., of any employe of the ..... Company, they designate and mean the chief engineer or one of his assistants. The decision of the chief engineer shall be final as to the intent and meaning of these specifications.

Specifications Part of Contract

82. The specifications and general conditions referred to are distinctly understood as being embodied with the contract, the whole forming the entire agreement, between the company and the contractor.

Proposed Form

Omit—conflicts with paragraph 15, page 960, and paragraph 19, page 961.

Omit—covered by the agreement, see page 955.

Omit—covered by the agreement, see page 955.

Omit—conflicts with paragraphs 24 and 25, page 961, and paragraph 26, page 962.

Omit—covered by the agreement, see pages 955 and 956

Appendix B—Economics of Filling Bridge Openings

This report was submitted at the twenty-fifth annual convention but owing to differences of opinion as expressed in open discussion on the floor was referred back to the committee for further consideration. However, the committee has not been able to develop any arguments that would justify any change in the report as originally submitted and recommends that the report be accepted and printed in the Manual. [This report was published in the *Railway Age* for March 13, 1924, page 664.]

Appendix C—Corrugated Metal Culverts

After a review of this subject and the information gathered on it up to the present time, the committee concluded that it would be necessary to make another campaign for information as data gathered so far was not sufficient to support definite conclusions. Consequently a complete questionnaire was formulated and sent to all railroad users of corrugated metal culverts. A list of such users was secured from culvert manufacturers. A considerable period of time will be required to secure answers to the questionnaire as an inspection of existing culvert installation is necessary.

Through the co-operation of the Armco Culvert and Flume Manufacturers' Association, the committee has been permitted to participate in some tests which it feels will be of great benefit to the Association and the engineering profession. The first of these tests was conducted at Middletown, Ohio, on May 8, last. This test covered strength of culvert and a 24-in. corrugated metal pipe and 24-in. concrete pipe were tested by application of pressure to the top of a 3½-ft. sand fill. Full and complete reports of this test will be published with the

final report on this subject when it is ready.

Arrangements for another test are now completed. This test requires the use of the Goldbeck cell, which is an electrical contact cell, for the recording of pressure and was developed by Mr. Goldbeck, engineer of tests of the Bureau of Public Roads, Department of Agriculture of the United States Government. These cells are to be installed on radial lines in the sides of cast iron, concrete and corrugated metal pipe and the pipe placed under actual fills before construction of the fill is started. Readings showing the various earth pressures on the pipe culverts will be taken as each two feet of fill is applied. The iron and concrete pipe is rigid While the corrugated metal pipe is more or less flexible, and these readings should reflect accurate information as to earth pressures on culverts, a subject of considerable difference of opinion in recent years. The test culvert pipes are to be installed under a new branch to be constructed by the Pennsylvania System in 1925. The pipe and Goldbeck cells are now ready for installation and the tests will go forward with the opening of construction in the spring.

Appendix D—Problems in Connection with Slips, Slides, and Water Pockets

A questionnaire was sent to representative roads over the country and replies were received from over fifty. About half of this number have had no difficulty with slips, slides, or water pockets, while the other portion reported some trouble of various kinds. The instructions called for a report on any unusual methods for handling roadway problems, and while the answers given show some unusual conditions, there was nothing to show unusual methods for handling these problems. In view of all this the committee feels that it has nothing to report.

There is one thing that has developed in this investigation which should again be called to the attention of the Association; this being the common method of building up the roadbed shoulder with clay or other impervious material. When this is done, either the roadbed shoulder is lifted above its normal position or the ballast is depressed into the roadbed, or both. It then follows that a pocket is formed under the track in which water is held by the impervious material which has been placed along the roadbed shoulders. In building up these shoulders either cinder or some porous material should be used instead of clay or other like material. In case this is not practical or possible and the banks must be widened or raised with impervious material, suitable cross drains should be placed to prevent water pockets.

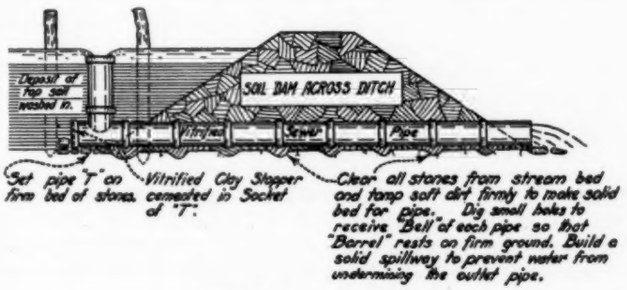
Appendix E—Methods of Keeping Down Dust

The most common method in use for elimination of dust has been a spraying with crude oil, but the practice is by no means general; and several railroads have discontinued it as being unsatisfactory. About 25 years ago the railroads of New England did considerable work spraying the roadbed but we know of no road in this region which continues the practice except in a very limited way in station and freight driveways. The officials of two roads state that they found the practice of oiling the roadbed wholly unsatisfactory. High speed trains had a tendency to pick up particles of sand which, being coated with oil, caused much damage to passengers' clothing. Another objection was that the oiled ballast lacked cohesion. One division engineer reports that the oil ran down along the side of the tie, making a water pocket, so that the track puddled badly and it was several years before successive renewals of ties overcame this tendency. One road depends on stone ballast for prevention of the dust nuisance. One road on the Atlantic seaboard considers oiling not only desirable but almost necessary.

Several roads in the middle west use oil to some extent. It appears that oiling the roadbed is done quite extensively on two roads in this region. In the arid and semi-arid districts of the southwest considerable oiling of the roadbed has been done. Two roads use water as well as oil for spraying the roadbed and report fairly satisfactory results.

The cost of oiling varies greatly. One road in the East uses 600 gal. of oil per mile and the total expense averages $35. One in the Middle West uses 2,000 gal. per mile at a cost of $85 and another used 2,500 gal. A transcontinental line reports that ordinary application of oil to roadbed without extensive spraying costs $100 per mile.

Some of the sand ballasted railroads of the South have planted Bermuda grass which in a short time covers the entire surface of the roadbed and eliminates dust.


Deposit of top soil washed in.
SOIL DAM ACROSS DITCH
Stream
Pipe
"Set pipe "I" on firm bed of stone.
Vitrified Clay Stopper cemented in Socket of "I".
Clear all stones from stream bed and tamp soft dirt firmly to make solid bed for pipe. Dig small holes to receive "Bell" of each pipe so that "Barrel" rests on firm ground. Build a solid spillway to prevent water from undermining the outlet pipe.

Sketch of a Soil Dam

The railroads along the Columbia river have a special problem to prevent the blow sand burying their tracks. This finely divided sand is brought down in the spring freshets and in the fall months the winds take it and carry it considerable distances. It has been found advantageous to spray the ground for a distance of 300 or 400 yards from the track, forming an asphalt coating on the surface which holds the sand in place. This costs from $30 to $40 per acre.

It would appear that railroads which are stone ballasted need have little trouble from dust except such as is picked up at road crossings and station yards and if these are oiled the result should be very satisfactory. Railroads which are ballasted with washed gravel or even with coarse gravel and on which speeds are moderate seem to have little trouble from dust. In regions where the ballast is light and sandy the dust becomes a great nuisance, especially in dry weather or in the desert country of the Southwest. It seems to be a general opinion that oiling the roadbed is advisable in sandy and desert regions where the rainfall is very light, but that the results are much less satisfactory in districts having a nominal amount of rainfall. There seems a quite general agreement that station and freight yards and driveways can be oiled to an advantage and the same is true of highways crossing or adjacent to railroad tracks.

Appendix F—Waterway, Channel and Bank Protection

Erosion, whether at right angles to the line of track or parallel thereto is a constant menace to the stability of the road bed. In first instance, particularly in cuts, an extraordinarily heavy rain not only carries down with it material which is deposited in the side ditches, but also in a great many cases overflows the track. In the second case, a gully is soon formed along the roadbed and unless steps are taken to prevent it, the embankment is endangered.

In the past, where erosion has formed gullies at right angles to the track, a common practice has been to use rip rap in the ditch in the hopes of stopping the erosion, before it entered the adjacent property holder's land—no particular attention being given to providing a safe channel for the water other than possibly trying to divert a portion of the water which fell with small ditches at the top of the cuts. At the present time, considerable thought is being given to providing a safe channel for the water rather than attempting to protect the earth itself. This is clearly brought out by the fact that culvert pipe manufacturers have on the market a semi-circular pipe and also by the concrete sluiceways, which several of the railroads are now using.

On embankment erosion at right angles to track, the usual practice has been to dump additional earth and if this did not prove effective to go to rip rap. At present time one railroad is preventing erosion of a steep embankment by the use of corrugated pipe which is raised above the embankment slope by the use of concrete piers. This not only elevates the outlet but also prevents clogging. On another line a cantilever installation of corrugated pipe has been made to prevent erosion of the fill. This installation carries the water beyond the toe of the slope.

Where the erosion is parallel to the track and where the flow of water is intermittent the usual practice has been to protect the embankment either by means of rip rap or the construction of a retaining wall. Either of these methods is expensive. An inexpensive method of combating the formation of gullies is to construct an earthen dam with a pipe through it of sufficient capacity to carry the water, this pipe through the dam being turned up so as to raise the point of intake. This checks the velocity of the water and causes the sediment to be deposited on the upper side of the dam before the water passes through the pipe. The success of this method depends upon having the outlet pipe through the dam so installed as to prevent leakage around the pipe and also on having the outlet end protected by a concrete or stone spillway so as to prevent undermining. Either corrugated pipe or vitrified tile can be used successfully in the above installation.

Discussion

The report was introduced by C. M. McVay, chairman, and turned over to the sub-committee chairmen for presentation. Following the presentation of the revision of the Manual, Chairman McVay *moved that it be accepted for inclusion in the Manual. The motion was carried.* Appendix B in the Economics of Filling Bridge Openings was next presented by J. C. Wrenshall, chairman of the sub-committee.

H. C. Crowell (Pa.): I wish to object to the inclusion of the report of the sub-committee in the Manual. It has thrown away entirely the theory of the annuity formula. There is only one method that will give correctly the annual cost of any structure, and that is the annuity formula. I suggest that the report be sent back to the committee again.

C. C. Cook (B. & O.): I quite agree with Mr. Crowell that we should not adopt a straight line formula by this association. I figured out, for instance, in one example where the committee gives the depreciation as $25.70; that computed on the annuity basis it becomes $1.86. I am not much concerned about the figure, however, as I am about the principle. There is another feature that I drew attention to last year. The Interstate Commerce Commission classification requires the ledger value of the structure retired as the amount that shall be charged to operating expenses, unless, of course, there is any salvage or any depreciation, plus the cost of the removal of the structure. We should not approve anything that is in conflict with the Interstate Commerce classification of operating expense as this is.

J. E. Willoughby (A. C. L.): The annuity method of accounting has no place in the replacement program. The replacement program is made by monies which the railroad company has. It is not the intention of any railroad company to set up a fund in order to procure sums of money for future replacements. The straight line method is the sensible way of getting at the cost to the railroad company of replacing a structure.

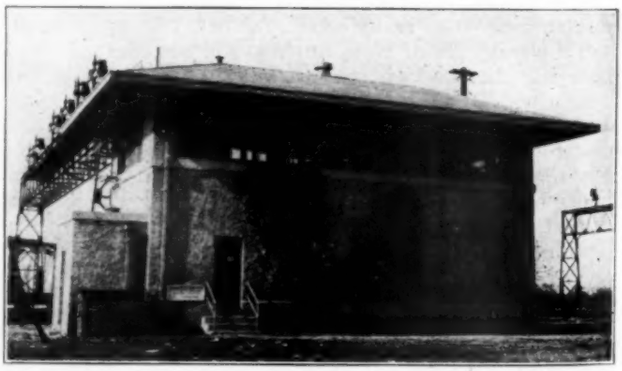
Chairman McVay: A number of the members of the committee are firmly of the opinion that Mr. Willoughby has expressed so ably; none of the railroads that we know much about have a sinking fund or a fund that these yearly amounts are put into to provide for the renewal of any structure when the time comes to renew it. We are not ready to recommend either way at present and if it is all right with the Association, the committee will submit this material as information at this time and a year from now we will come back with it and try to work it out in both ways and at that time express our preference, if we are able to get together on one, as to the method.

Chas. S. Churchill (N. & W.): The committee's suggestion is the correct one under the circumstances, for this reason: The Interstate Commerce Commission will probably inside of a year reach a conclusion on this matter because they themselves are anxious to and have had in hand for some time the revision of the accounting system and they naturally will not postpone it very much longer. This committee would do well, therefore, to hold it over until that revision has been complete. That revision would include this matter of handling fixed property depreciation, and you know that the railroads have quite a different opinion from the committee of the government on that subject, so there is a very broad question involved.

R. H. Ford (C. R. I & P.): Irrespective of what the committee has said as to the ready method of their estimates, the principle is wrong. We are a body of engineers and we do not want to sacrifice principle. I hope that the committee will take this report back and give it further study.

Chairman McVay: The committee will, therefore, offer this report as information and will report on it again next year.

(The other sub-committee reports were next presented and were accepted as information without discussion. The committee was then dismissed with the thanks of the Association.)



Concrete Signal Tower on the Dallas Terminal Railway

Report of Committee on Wood Preservation

Owing to the increased use of treated timber and the decreased quantities of creosote which are available in recent years, the question of the suitability of mixtures or combinations of that and other preservatives becomes particularly pertinent. The report of the Committee on Wood Preservation this year continues the study of this subject from last year and presents additional information on creosote and petroleum and zinc chloride and petroleum mixtures. For inclusion in the Manual, the committee submitted specifications for standard float test and for thermometers used in creosote distillation and also a method for the analysis of zinc chloride. S. D. Cooper has been chairman of the Committee on Wood Preservation for two years and a member of it for the last three years.

S. D. Cooper
Chairman

THE REPORT of the Committee on Wood Preservation was presented under six heads in Appendices A to F, inclusive. Appendix A covered revisions of the Manual; Appendix B, service test records on ties and fence posts; Appendix C, treatment with a mixture of creosote and petroleum; Appendix D, treatment with a mixture of chloride of zinc and petroleum; Appendix E, marine piling research and Appendix F, the effect of preservatives on the inflammability of wood.

The committee recommended that Appendix A, revision of the manual, be approved, and that Appendices A, B, C, D, E, and F be accepted as information.

Committee—S. D. Cooper (A. T. & S. F.), chairman; F. C. Shepherd (B. & M.), vice-chairman; R. S. Belcher (A. T. & S. F.), H. C. Bell (N. & W.), E. H. Bowser (I. C.), Z. M. Briggs (Penna), J. R. W. Davis (G. N.), G. F. Eberly (B. & O.), J. E. Fanning (I. C.), H. J. Force (D. L. & W.), C. F. Ford (C. R. I. & P.), Andrew Gibson (N. P.), R. H. Howard (Wabash), J. E. Johnson (P. M.), J. F. Pinson (C. M. & St. P.), W. H. Kirkbride (S. P.), J. B. McClain (S. A. L.), Frank Ringer (St. L.-S. F.), B. H. Prater (O. S. L.), O. C. Steinmayer (Can. Creo. Co.), Dr. Hermann von Schrenk (Con. Engr.), J. W. Williams (W. P.), J. H. Waterman (C. B. & Q.).

Appendix A—Revision of the Manual

The committee presented specifications for a standard float test and specifications for thermometers used in creosote distillation to replace specifications now in the manual. It presented also a method for the analysis of zinc chloride as new material for inclusion in the Manual.

Appendix B—Service Test Records

In conformity with the policy adopted some years ago, the committee presented additional completed service records of test ties and a table of tie renewals per mile on various railroads. [This was published in the *Railway Age* for February 7, 1925, page 367.] The committee also presented a report on a test of treated fence posts conducted at Cleveland, Texas, which was reported in abstract in an illustrated article in *Railway Engineering and Maintenance* for December, page 489.

Appendix C—Treatment With a Mixture of Creosote and Petroleum

This report is a continuation of report made by the sub-committee last year on the subject "Creosote Mixture with Other Oils," Appendix E, report of Committee on Wood Preservation.

Conclusions

(1) Creosote for mixture with petroleum shall be any of this Association's standard grades of creosote. Creosote-coal tar solution may be used with certain kinds of petroleum.

(2) (a) The petroleum should be preferably of asphalt base, but a petroleum of mixed paraffin and asphalt may be used where such a petroleum is found which mixes with creosote in the required proportions without forming more than one per cent sediment.

(b) The specific gravity of the petroleum is not important.

(c) The minimum flashpoint of the petroleum in closed tester should be 225 deg. F.

(d) The maximum viscosity of the petroleum should be such that when mixed with creosote in desired proportion at treating temperature the mixture will readily penetrate the wood.

(3) The percentage each of creosote and petroleum in the mixture, and the final retention of mixtures per cubic foot of timber is a matter best left to the individual railroads, and in making decision as to this, climate, kind of woods to be treated, method of treatment used, etc., should be considered.

(4) Petroleum adds to the life of timber by retarding or preventing checking and splitting of the wood.

(5) Creosote-petroleum mixture, made up of grades of creosote and petroleum as indicated in the above, and containing sufficient creosote to prevent decay of the wood, is an economical and satisfactory preservative in many regions.

Appendix D—Treatment With a Mixture of Zinc Chloride and Petroleum

During the past year, a process has been developed at the Mellon Institute of Industrial Research, Pittsburgh, Pa., by means of which zinc chloride and petroleum is injected into the timber in the form of an emulsion composed of zinc chloride solution of 15 to 40 per cent strength and a mixture of heavy asphaltic base petroleum thinned to desired viscosity by means of gas oil or petroleum distillate.*

Conclusions

(1) The result obtained from zinc chloride-petroleum treated ties indicate that the addition of petroleum to the zinc chloride will under most condi-

*This process was described in an abstract of a paper presented before the convention of the American Wood Preservers' Association which appeared in the *Railway Age* for February 7, 1925, page 365.

tions add to the service which is obtainable from the use of straight zinc chloride only.

(2) There are certain *operating difficulties* encountered in the experimental work which have not yet been solved, but experimental work along this line during the past year, described in this report, has been very encouraging.

Appendix E—Marine Piling Investigation

The Committee on Marine Piling Investigation has only a brief progress report to submit this year. At the request of the Board of Direction, this committee prepared to take over some of the work of the Marine Piling committee of the National Research Council when that committee went out of existence early this year. Due, however, to delayed negotiations as to transfer of files, it has been impossible for the committee to do much active work on this problem other than to maintain supervision of some of the tests still outstanding.

Appendix F—The Effect of Preservatives on the Inflammability of Wood

The question as to whether creosoted decks on trestles and creosoted ties on steel bridges are any more susceptible to being burnt than if the material used was untreated yellow pine has for some time past become a debatable question. It is quite true that freshly creosoted timber is more susceptible to fire than sound untreated timber. Freshly creosoted timber, however, need not be used for all parts of the deck. It is possible to treat the ties and guard rails on trestles and let them dry before they are put in the deck, and all of the ties and guard rails used on a steel bridge can be framed treated and dried after treatment. The drying of treated timbers is accelerated to a great extent by a vacuum after the timber is treated and this final vacuum has become almost a universal practice at treating plants.

The fact that heretofore creosoted decks have been protected either by ballast deck construction with ordinary track dies embedded in the ballast or with a small amount of ballast being applied for the sole purpose of fire protection, and also in many cases galvanized sheet iron being used, makes it difficult to give from the fire records of railroads any definite comparison between treated and untreated decks as to fire risks.

We can, however, compare the fire risk in creosoted and untreated pile bents which are susceptible to being burnt from grass or forest fires and which undergo very little risk from fire starting directly by hot coals from the ashpan or sparks from the engine stack.

The records as far as we are able to find show that there is certainly no more risk in the creosoted substructure, and, in many recorded cases, the fire risk is shown to be less. We have a few notable examples to prove that creosoted material when dry is not as susceptible to fire as untreated material and it is no harder to put out than untreated material. In most cases creosoted timber will stop burning after the excess oil has passed out of the wood, as it only burns as long as the heat converts the oil into gas, and when the excess oil is exhausted the fire goes out.

The most conspicuous example of this is the fire on the Nashville, Chattanooga & St. Louis. [An account of this fire appearing in the Railway Maintenance Engineer for September, 1921, page 335, based on information furnished by Hunter McDonald, chief engineer, stated that the damage done totaled only $75 although the fire lasted 2½ hours.] Anyone who has had experience with fires in untreated pine trestles will realize that such a fire could not have occurred in a trestle as old as this if built of untreated pine.

In 1907 a fire started in piling at the treating plant at Grenada, Miss. The yard was crowded with material and the fire spaces were filled. It was burning fiercely in these freshly creosoted piles before the hose could be gotten to the fire. However, after the water was started it was not long before the fire was extinguished and the fire was stopped in the center of a rick of about three hundred piles. Half of the length of these piles were charred and the other half untouched by the fire. Where the butt ends of the piles were not charred they were cut into 30 and 40-ft. lengths.

In 1908 there were a number of piles of creosoted pine ties treated by an empty-cell process, in a yard near Gloster, Miss. These ties were stacked in alternate solid layers directly on the ground and the stacks were some distance apart. Later the tie producers filled this yard with pine ties and after inspection they were in the yard for three or four months. A grass fire set the untreated ties on fire, and these untreated pine ties were practically all destroyed. The creosoted ties were not injured except some of them were slightly charred.

W. H. Courtenay, chief engineer of the Louisville & Nashville, writes:

"I can now recall but one creosoted trestle on the L. & N. which was totally destroyed by fire. We had one overhead bridge constructed of creosoted material which was totally destroyed by fire.

"There are a large number of creosoted trestles on the L. & N. lines, and we have had a good many fires on them, but have generally succeeded in putting them out before very great damage was done.

"Our experience leads us to believe that after creosoted trestles have been in use a short time they are not as apt to become ignited as old untreated trestles."

The chairman of the sub-committee is familiar with the creosoted telephone poles in marshes between Bay St. Louis and New Orleans, and has been observing them for 25 years. He has seen these poles swept by grass fires a number of times and has never seen a creosoted pole destroyed. Practically all of the poles in this line were creosoted. The chief engineer of the Southern Bell Telephone Company advised that the untreated poles used formerly were frequently destroyed by fires in the winter months.

Discussion

[The report of the committee was introduced by its chairman, S. D. Cooper (A. T. & S. F.) and the sub-committee reports were presented by the chairmen of the various sub-committees. Dr. H. Von Schrenk (N. Y. C.) outlined the report on the revision of the Manual in Appendix A and then *moved that the specifications included therein be adopted. (Motion carried.)* C. F. Ford (C. R. I. & P.) then presented the sub-committee report on service test records of ties and fence posts, following which R. S. Belcher submitted the report contained in Appendices C and D on the general subject of creosote mixtures with other oils. The status of the committee's co-operative efforts in connection with the committee on marine piling investigation of the National Research Council was discussed by Dr. Von Schrenk, the sub-committee chairman.]

Dr. Von Schrenk: The committee has done very little this year except to keep track of such work as is going on abroad and the work done specifically in this country by the Chemical Warfare section of the War department. Due to lack of funds the committee of the National Research Council has been practically in a quiescent condition this year. The Chemical Warfare section has pursued the subject with great vigor at the Edgewood arsenal during the past year. It has developed three specific compounds of which a series of treated piles have been

prepared and are ready for distribution at the present time. Your committee has been asked to assist in the placing of these various sections at various points on our coast. These compounds are all different from anything that has ever been used in the treatment of marine piling heretofore, and their development has come about as a result of co-operative work in the government laboratories between the chemists of the Chemical Warfare section and the zoologists connected with the Smithsonian Institute under the immediate direction of the War Department.

[The sub-committee report on the inflammability of creosoted timber was presented by E. H. Bowser (I. C.), who read from Appendix F.]

Hunter McDonald (N. C. & St. L.): We had a fire at one of our bridges recently. The untreated bent burned out and the other bents remained damaged only where the bracing was attached to them, points of contact; in some cases the braces had to be removed, but it was only about an hour after the bridge burned out, after the oil burned out of the timber that we were able to resume traffic over it. There is less risk in the use of treated timber than there is the other, provided proper steps are taken to keep the fire from going too long. Bridges ought to have fire walls every two or three hundred feet.

J. L. Campbell (S. P.): During the past seventeen or eighteen years, on the roads with which I have been connected the tie renewals have been reduced annually from 10 or 12 per cent to 5 or 6 per cent, and we somewhat more than doubled the life of the tie. We found that we were taking out ties at the end of 16 or 17 years, not due to any decay in the tie, but to its failure through this physical or mechanical disintegration.

But the one thing I want to direct your attention to and impress upon you is that if you are not familiar with this proposition you should get familiar with it, and get yourself squared so you will have a broad, comprehensive understanding of the ultimate economies that are involved, and that you help your railroad, if it is not already there, to get to the point where it will preserve the timber.

G. W. Snyder (Penna): We have a practical question on the treatment of ties. If the life of a treated red oak on our eastbound freight tracks is going to be no longer for physical reasons than the untreated white oak on the freight tracks then perhaps we ought to buy white oak ties.

C. W. Baldridge (A. T. & S. F.): The life of a white oak tie untreated is very much less than the life of almost any treated tie, and if it is not possible to lengthen the life of a white oak tie by treatment.

E. W. Hammond (B. R. & P.): We have had experience in the use of creosoted red oak ties as against untreated white oak ties, which would tend to show more efficient life from treated red oak when protected against mechanical wear than from the white oak.

Mr. McDonald: I believe that the life of the red oak ties can well be justified in tracks, provided a large tie plate is used in order to completely eliminate the effect of the sand as well as the increased weight on the low side of the curve.

John Foley (Penna.): The treatment of ties will add enough to their life by resistance of decay to justify the treatment, even though extreme traffic conditions prevail. The cost of renewal is so large that even a year added life justifies the cost of treatment.

C. C. Cook (B. & O.): We can get at least two-thirds of the amount of treatment into a white oak tie that we can get into the red oak tie. The advantage of the white oak treated tie lies in putting it on the heavy curves and on heavy grades where it will resist mechanical wear very effectively.

[The committee was dismissed with the thanks of the association.]

Report on Rules and Organization

For a number of years the Committee on Rules and Organization has been at work on the preparation of a complete set of rules for the guidance of employees in the maintenance of way department for substitution in the Manual in place of those now included in this publication. These rules were submitted in 1924 and were referred back to the committee for revision and are being presented this year in their revised form. In addition to these, other rules are submitted for the first time for inclusion in the Manual of Rules. These cover rules in regard to electrified territory, conduct of work, water service and inspection of buildings and are recommended for adoption in the Manual. W. C. Barrett has been chairman of this committee for five years and a member for the last six.

W. C. Barrett
Chairman

IN AN APPENDIX A the committee submitted a revision of the Manual of Rules for the Guidance of Employees of the Maintenance of Way Department for substitution for the present rules in the Manual. It also presented in an Appendix B, additional rules for inclusion in the Manual as a part of the above mentioned Manual of Rules. These added rules included ones for the Guidance of Employees in Electrified Territory; the Conduct of Work; Water Service and the Inspection of Buildings. In Appendix C, which was submitted as information, the committee presented rules for Handling Explosives, Scrap and Refuse Material; for Procedure in Case of Accident, and for Governing First Aid to the Injured.

Committee: W. C. Barrett (L. V.), chairman; E. H. Barnhart (B. & O.), vice-chairman; M. M. Backus (I. C.), B. Herman (Sou.), D. P. Beach (Penna.), J. L. Jamieson (C. P. R.), C. W. Brown (L. & N. E.), B. R. Kulp (C. & N. W.), H. L. Browne (C., M. & St. P.), E. F. Manson

(C., R. I. & P.), Carl Bucholtz (Erie), R. N. Priest (A. T. & S. F.), E. N. Burrows (Cornell Univ.), E. M. Smith (B. & M.), W. M. Camp (Railway Review), J. W. Stevens (N. Y. C.), P. D. Coons (C., B. & Q.), C. H. Tillett (C. N. R.), J. L. Downs (I. C), R. E. Warden (M. P.), J. M. Fair (Penna.), A. A. Woods (Sou.), H. H. Harsh (B. & O.), C. R. Wright.

Rules for Inspection of Buildings

General—1. The inspection and maintenance of all buildings will be under the direct supervision of..... (Title) ....., who will be responsible for the proper upkeep.

2. The.....(Title).....shall personally inspect every building in his territory at least once each year.

3. As many competent inspectors, who are familiar with general building construction and maintenance and who have a knowledge of good practice, as may be necessary to properly cover the territory will be assigned to this inspection under the direct supervision of the.....(Title).....

4. These inspectors shall forward to the.....(Title)..... in (duplicate) (triplicate) on the proper form (1) provided, a report of each building or structure inspected, stating in detail the condition found, covering, however, only parts of work requiring repairs or renewals. One of these forms shall be forwarded for each building inspected, shall be complete in itself, showing actual conditions found, regardless of previous reports. Report shall be forwarded at the close of each day's inspection.

5. The.....(Title).....shall examine these reports, and if any defects of a serious nature are reported, take immediate steps to make necessary repairs. After the.....(Title).....examines the reports he will send one copy to his superior officer, calling particular attention to the serious defects, advising action taken for correction, and also to the defects which are not serious but are sufficiently urgent or important to warrant the attention of such officer.

6. The.....(Title).....shall make a personal inspection of each building or structure not less than once each year; shall examine the inspection reports forwarded him by subordinates, keeping his immediate superior officer promptly informed of any defects which require attention. He shall make recommendations to his superior officer of the work to be done to remedy conditions or to make permanent improvements. He shall at regular intervals make report to his superior officer on proper form (2) covering results of division inspectors' reports, state action taken to remedy defects or make recommendations to cover such work. He shall frequently examine his card index to become familiar with the condition of the buildings under his charge. He shall furnish annually a report to his immediate superior officer, stating the condition of each building and other structure on his territory.

7. The.....(Title).....and his subordinates shall be thoroughly familiar with the condition of all buildings and structures under their immediate charge.

8. At least once each year a general inspection shall be made by the head of the department or his representative, who is directly responsible for the maintenance of buildings and structures. From this inspection, a program of all work necessary during the ensuing year to keep the building in safe, sanitary and presentable condition will be prepared.

Field Inspection—9. Division building inspectors will report to and receive instructions from.....(Title)..... In selecting inspectors, particular attention should be given to their judgment, previous experience and familiarity with the buildings in the territory to which they are to be assigned.

10. It shall be the duty of the division building inspector to inspect all buildings and structures in his territory other than bridges, trestles and track structures.

11. The division building inspector shall at the close of each day send to the.....(Title).....a report on approved form (1) in (duplicate) (triplicate) showing defects, if any, giving a clear description of the defects in sufficient detail so that materials for correction may be ordered, if the case be urgent. Every part of the structure must be examined from foundation to roof, inclusive. Special attention should be given to the inspection of foundations and roofs, to heating and plumbing appliances and such facilities as may through lack of proper upkeep cause accidents, loss in time or money or serious inconvenience to the public. In the event that the entire structure is found in good condition, a check mark on the report in space provided for the purpose is all that will be required and no details need be given. Each report shall cover only a single structure and shall be filled in on the form as soon as the inspection is completed.

12. Careful inspection shall be made of the steel roof construction in all locations where soft coal gas is prevalent as in engine houses, boiler and smith shops, train sheds, etc.

Records—13. The.....(Title).....upon receiving reports from the division building inspector, after carefully examining same shall have the information entered on a card index file. This index file should have guide cards for each location and class of structure and sufficient data cards back of each guide card on which to copy essential information from the division inspector's reports.

14. The location guide card should show "Location or Milepost," Division, Valuation Section and Number.

15. The guide cards for various classes of buildings should be of different colors, for "Stations and Office Buildings," "Roadway Buildings," "Shops and Engine Houses," etc.

16. The inspection data cards should show the name of building, location, number, date erected, general dimensions, character of construction (i. e., frame, brick or concrete, etc.) and should have sufficient space in which to write the important facts shown on the inspection forms; one or more cards being used for a building as the case may require.

Forms—17. The following forms are recommended for use of:

(1) Division building inspector.
(2) .....(Title).....periodical report to his superior officer.
(3) Card record in.....(Title).....office.
(4) Card record in.....(Title).....office.
(5) Card record in.....(Title).....office.

18. The forms for division building inspector's use should be printed in books of 100 or more leaves, each perforated with carbonized back, with stiff cardboard or linen backs of a size not exceeding 4½ in. by 6½ in.

19. The forms for card index in.....(Title)..... office should be similar to samples of any standard manufacture.

20. The.....(Title).....periodical report of building inspection to his superior officer should preferably be correspondence size with no ruled cross lines.

Discussion

A. H. Rudd (Penna.): I would just like to change one word in Rule 900, under Signals and Interlocking, substituting the word "clear" for "free," so that it will read: "The track should be kept clean and ballast kept clear from rails."

W. C. Barrett (Chairman): The committee has no objection to making that change. *I move that the material shown in Appendix A be substituted for that now appearing in the Manual.*

G. W. Rear: In looking over these rules, I find there is a very large number of rules that are purely rules containing instruction. Is it the intention of this committee ultimately to provide a rule for every part of work that any particular gang of men would do? Our rules are too elaborate and many of the rules that contain only instruction should be put out in different form.

E. M. Grime (N. P.): I am thoroughly in accord with the words of the last speaker. The committee has included considerable here that is merely instructions and not rules. As a member of the Committee on Water Service I know we had something to do with some of these rules. I think there is a lot of information here that should be left under the Water Service Committee's section of the Manual.

Chairman Barrett: In trying to discriminate between instruction and rules it is hard to draw the line of demarcation and the committee did the very best it knew how.

C. W. Baldridge (A. T. & S. F.): Most motor cars that I am familiar with are provided with sweepers that will frequently knock the torpedo off the rail. I would suggest that Rule 278 be revised to read "Care must be exercised to avoid running over torpedoes but if torpedoes are exploded or knocked off the rail by motor, hand velocipede or push-cars they must be replaced."

J. M. R. Fairbairn (C. P. R.): Under Rule 723, I note that the temperatures are given and the spacing for each temperature. Would it not be advisable to add to

that something to tell how the temperature is to be taken? There is nothing there to indicate whether it is the temperature of the air or the rail or how it is to be taken at all.

Mr. Baldridge: The Track Committee is bringing in in their report this year a new table for expansion shims and taking care of different lengths of rail. It will be in order for this rule to be revised in another year to conform with whatever is adopted on the Track Committee's recommendation.

Chairman Barrett: We will be very glad indeed to revise that rule next year to include what Mr. Fairbairn suggests.

[*The motion to adopt the rules under Appendix A was carried. The chairman then presented Appendix B.*]

Chairman Barrett: *I move that the rules found in Appendix B be approved for printing in the Manual.* (*Motion carried.*)

President Ray: If there is no discussion on Appendix C, which is to be received as information, it will so stand.

The committee was dismissed with the thanks of the association.

Report on Shops and Locomotive Terminals

Last year the Committee on Shops and Locomotive Terminals presented a report on typical layouts for the storage and distribution of fuel oil. The discussion on the report indicated that further consideration should be given to the subject and the committee accordingly revised its report of last year and presented the revised report with the recommendation that the conclusions be approved for publication in the Manual. The committee also presented designs of car shops for adoption and publication in the Manual. It submitted as information a report on the ventilation of enginehouses in which it called attention to the relations between the heating and ventilating systems, and recommended a hot blast heating system. F. E. Morrow has been chairman of the committee since its organization.

F. E. Morrow
Chairman

THE COMMITTEE presented a report covering the General Layout and Design of Car Shops (Appendix A), Typical Layouts for Storage and Distribution of Fuel Oil (Appendix B), and The Ventilation of Engine Houses (Appendix C). The action recommended by the committee was (1) that the recommendations in Appendix A and (2) the conclusions in Appendix B be approved for publication in the Manual and (3) that Appendix C be received as information only.

Committee: F. E. Morrow (C. & W. I.), chairman; A. T. Hawk (C. R. I. & P.), vice-chairman; C. I. Anderson (I. C.), G. W. Harris (A. T. & S. F.), A. L. Atwill (C. & W. I.), E. M. Haas (con. engr.), C. N. Bainbridge (C. M. & St. P.), L. P. Kimball (B. & O.), G. W. Burpee (Coverdale & Colpits), W. H. Kirkbride (S. P.), Leland Clapper (D. & I. R.), W. T. Krausch (C. B. & Q.), M. J. Davis (Penna.), H. M. Lull (S. P.), R. E. Dougherty (N. Y. C.), J. S. McBride (C. & E. I.), K. B. Duncan (G. C. & S. F.), J. M. Metcalf (M.-K.-T.), G. H. Gilbert (Sou.), L. K. Sillcox (C. M. & St. P.), Walter Goldstraw (C. N. R.), John Schofield (C. N. R.), R. J. Hammond (B. & M.), B. S. Voorhees (N. Y. C.), Geo. W. Hand (C. & N. W.), H. W. Williams (C. M. & St. P.), A. M. Zabriskie (C. R. R. of N. J.)

Appendix A—General Layouts and Designs of Car Shops

The recommendations offered by the committee with respect to car shops are as follows:

1. The distance from the center line of the outside car repair track in a car shop building to any projection on the outside wall should be not less than 11 ft.

2. The distance center line to center line of repair tracks that have a standard gage material track between them should be not less than 22 ft.

3. The distance center line to center line of repair tracks that do not have a material track between them should be not less than 18 ft.

4. The distance center line to center line of car repair track where a row of columns is located between the tracks, should not be less than 22 ft. and in no case should the distance from face of columns to center line of adjacent repair track be less than 10 ft.

5. The minimum distance from the top of rail to bottom of traveling crane bridge, in car shops that do not lift cars over each other, should be 23 ft.

6. Car repair shops should be arranged so that cars can be switched from both ends.

7. Material tracks in car repair shops and yards should be standard gage.

8. That portion of the car repair shop floor between the outer rails of adjacent repair tracks, having a material track between them, should be paved or planked and suitable paved or planked roadways should be extended out into material yards to facilitate trucking and the use of tractors for handling material.

9. In shops where cranes are not employed the overhead clearance, measuring from top of rail should be not less than 20 ft., door openings excepted.

10. Except where otherwise prescribed by law, repair track door openings should not be less than 13 ft. wide by 17 ft. high.

11. Suitable provision should be made in the formulation of plans to provide for reasonable extensions of all buildings and facilities.

12. Suitable means should be provided for prompt and economical handling of materials and supplies through the application of cranes, hoists, mono-rails, supply tracks and roadways for tractors and trailers.

13. It is recommended that fireproof or slow-burning construction be employed for the building structures.

14. It is recommended that the roof and side wall construction be such as to afford maximum natural light and ventilation.

15. Ample artificial illumination is recommended.

16. Heat is recommended, for the colder climates.

17. Separate building is recommended with excess heat and good ventilation for painting and stenciling for cold or rainy climates.

Appendix B—Typical Layouts for the Storage and Distribution of Fuel Oil

Following the discussion of the report on fuel oil facilities in the convention last March, further consideration has been given to the subject by the committee, with special reference to the questions raised at that time. This led to a partial revision of the conclusions presented last year to the form presented below.

Conclusions

1. Where oil is used as fuel for locomotives the facilities required include provision for unloading it from cars, for holding it in storage, and for delivering it to locomotive tenders.

2. The details of design necessarily vary with the composition and gravity of the oil to be used and the climatic conditions to be encountered, as they affect the temperature which must be maintained in the oil for convenient handling.

Unloading Facilities

3. Oil should be unloaded from tank cars by discharging direct into a trough or boxes of steel or concrete between the rails of track on which cars stand for unloading. Where boxes are used, they should be spaced at car-length intervals for convenience in spotting cars for unloading. Troughs or boxes should be equipped with metal covers, kept closed when not in use. The unloading facilities should be located on a track assigned for this purpose, and so that it will be unnecessary for locomotives to pass over them.

4. Unloading trough or boxes should deliver oil by gravity through pipe line to depressed sump from which it may be pumped to storage or delivery tank. Such pipe line should be of sufficient size and be laid with sufficient gradient so that oil will flow by gravity to the sump as fast as it will be discharged from the total number of cars which will be opened at any time. This should not be in excess of the capacity of the pumps.

5. Sumps may be of steel or reinforced concrete and should be covered. They should have capacity of not less than one carload. If of steel, the pit should be drained or the sump should be anchored to prevent displacement by ground water when empty. The sump should be vented to draw off gases generated by heating oil in the sump tank, and in some circumstances it may be desirable to install an oil trap or barrier in the pipe line leading from the sump to the track trough or box to prevent the flow of gases from the sump to the track trough or box.

Storage

6. The storage capacity which should be provided depends largely upon reliability and source of supply and probable variations in market price of oil. In general, there should be at each station sufficient storage to protect against any interruption which may occur in the delivery from the regular source of supply. Additional storage for the purpose of taking advantage of variations in market conditions may either be located at various terminals where oil is used, or concentrated at one conveniently located point.

7. Cylindrical steel tanks of 55,000 and 80,000 bbl. capacity, erected on leveled earth foundations, provide convenient and economical storage, and can commonly be secured promptly and at less cost on account of being standard construction with tank manufacturers. Roofs should be provided of steel or of wooden frame and sheathing, covered with asbestos, composition, tar and gravel, or sheet metal roofing. In permanent installations, or where oil having large gasoline content is to be handled, gas-tight steel roofs equipped with breather pipes with outlets outside the dike and floating roofs have the advantage of reducing evaporation of gases, and danger of fire. Each tank should be surrounded by an earth dike, enclosing below the elevation of top of dike a volume equal to one and one-half times the capacity of the tank.

8. Adequate means should be provided for the escape of gases thrown off from the surface of the oil. The character and extent of such provision required will depend on the tightness of the roof and the character of the oil. It should be designed to reduce circulation of air over the surface of the oil to a minimum consistent with prevention of building up of pressure due to the accumulation of gases.

9. Provision should be made for draining off water and refuse which may settle in the bottom of tanks.

Delivery

10. Oil may be delivered to locomotive tenders by gravity from elevated steel tanks or under direct pump pressure. In general the former method is more convenient and economical. If the gravity system is used, particular attention should be given to the introduction and proper location of cut-off valves in the delivery lines, so that the flow of oil from the tanks can be immediately controlled.

11. The size of delivery tank required varies with local conditions, as to receipt and handling of oil, but the capacity should, in general, be not less than the average amount of oil to be delivered in twenty-four hours.

12. Valves should be provided for draining off water and refuse which may accumulate in the bottom of tanks.

13. Delivery columns should be so constructed that spout can be swung to position and valve opened from the locomotive tender to be served. Spouts should have maximum freedom of movement in both horizontal and vertical directions, consistent with prevention of leakage. They should be provided with drip bucket, reversible end elbow, or other means to prevent drip.

14. Means should be provided for measuring accurately deliveries of oil. Meters in delivery pipe lines or gages on engine tenders serve satisfactorily to that end.

15. Some wastage of oil around an engine terminal is inevitable and provision which will reduce such wastage to a minimum is an important item in design of facilities for handling oil. If all unnecessary waste and leakage is eliminated the cost of recovery of waste oil is generally in excess of the value of the oil. In cases where such waste is excessive or becomes a nuisance, however, and causes damage to neighboring property, it becomes necessary to provide traps in drainage channels or sewers, equipped with baffles, to catch the waste oil, separate it from water, and permit its recovery by dipping or pumping back to the sump. Such appliances are being used successfully.

Heating

16. Where heavy oil is used or where cold temperatures are experienced, it is necessary to provide means for heating oil in cars, tanks and pipe lines, in order that it may flow freely. Such heat is best produced by steam pipes.

17. Pipe coils in tank cars, which can be readily connected by flexible hose or pipe to steam pipe lines from

the pump house, provide satisfactory means for heating before unloading. The discharge of live steam directly into the oil in the car may be resorted to in case heating coils are out of order or the car is not equipped.

18. Similar steam pipe coils provide satisfactory heat for storage and delivery tanks. In larger tanks they are more effective if enclosed with the end of the discharge line leading from the tank in a wood box so that the heat will be applied directly to the oil as it leaves the tank, and not disseminated through the whole tank full of oil. The heating of oil in pipe lines will often prove advantageous and may be accomplished by introduction of small steam pipe lines inside the oil lines, or by enclosing steam line inside an insulating box alongside the oil line. The latter method simplifies construction and maintenance, but requires more expensive first installation and greater consumption of steam in proportion to the results obtained.

19. Where steam lines are installed in oil lines, it is necessary to take precaution against excessive heating. On this account, it is not recommended that steam lines so installed be larger than necessary for heating the pipe line. Steam for tank coils and other purposes may better be carried outside the oil lines.

Small Stations

20. While the foregoing recommendations apply primarily to the larger stations, yet the general principles apply to the small stations except that their application requires special adaptation to the problem. In some cases, the oil is used direct from the cars; in other cases, storage from one or more cars is combined with delivery tanks, delivery being made either by gravity, pumps or air pressure.

Appendix C—The Ventilation of Engine Houses

There are two principal causes of impure air in engine houses as follows:

(1) The escape of smoke from smoke stacks.

(2) The escape of steam when a boiler is blown off.

If care is taken in operation to see that these causes are held to a minimum, reasonable provisions in the design for ventilation will not be overtaxed. It is not an uncommon occurrence, however, to see locomotive emitting quantities of black smoke when smoke stack is not spotted under smoke jack in the roof. Also not infrequently steam is blown off directly into engine house without making a connection to piping provided for the purpose of conveying this steam to the outside air or to boiler washing system.

The following recommendations have particularly to do with ventilating features, although they reiterate certain features of previous report which have a particular bearing on ventilation.

Smoke Jacks.—Smoke jacks should be of the fixed type, at least 42 in. wide, of such length (preferably at least 12 ft.), as to permit the locomotive stack to be spotted under the hood of the jack at all of the various positions of the locomotive made necessary for the accomplishment of certain repair operations. The position of the jack in the roof should be established with the above condition in view and the elevation of the bottom of hood should be as low as the height of the locomotive will permit. The area of flue opening should be at least seven square feet. An annular space two inches in width should be provided around the flue. Smoke jacks should not have dampers. In moving locomotives into the house they should be spotted with the smoke stack under jack as rapidly as consistent with safe handling and should always be kept in such position while under fire.

Steam Blow-Off—Provision of a proper system of piping for blowing off steam from boilers should be made in every engine house. Where possible the steam blown off should be used for heating purposes in connection with a boiler washing system, but in all cases discharge should be made outside the limits of the engine house. A ventilator of standard design and at least 18 in. in diameter should be placed in the roof on the center of each stall and as nearly as possible over the center of steam dome of locomotives handled. If regular blow-off piping is temporarily out of service, arrangements should be made to blow off through portable pipe into this ventilator and the blowing off of locomotives without such provision should be absolutely prohibited.

Cross-Section of House—As modern engine houses have stalls generally 100 ft. or more in depth, at least one break should be made in roof and if desirable a complete monitor may be installed. Such breaks or monitors should be provided with pivoted sash or a combination of pivoted sash and fixed louvres.

Framing—Roof framing should be such that the rafters directly supporting the sheathing or other roof surface are in radial lines and without pockets so as to permit the free passage of smoke to the eaves. At the eaves directly under the roof sheathing, if climatic conditions will permit, a continuous opening of four to six inches should be provided to permit the escape of smoke and steam, particularly at breaks and in monitors.

Windows—Large windows should be provided in the outer walls with a generous provision of ventilating sections. As near a continuous row of these ventilating sash as practicable should be provided along the top of windows.

Heating—The relation of the heating system to the ventilation of the engine house is, of course, apparent. The provision of a hot blast heating system with a supply of air taken exclusively from outside the house and circulation by means of underground ducts with outlets in pits and along the outer wall just above floor level is recommended for general use.

The provision of special smoke jacks with a system of ducts and induced draft for the collection and disposal of smoke from locomotives which has been installed in certain locations by a number of roads is not recommended for general use on account of the prohibitive expense involved in making such an installation. The use of such a system should be confined generally to engine houses in congested city districts where the collection and disposal of locomotive smoke is necessary to meet local requirements.

Discussion

(The report was introduced by A. T. Hawk, vice-chairman, and the sub-committee reports presented by chairman of the sub-committees. H. W. Williams presented the report on Appendix A, general layouts and designs of car shops. *It was moved that the report be accepted and published in the Manual.*)

J. E. Armstrong (C. P. R.): If these conclusions 2 and 3 are adopted as they stand, there may be a conflict in the recommendations of two of the committees. On page 684 of the current Manual, at the foot of the page, the Committee on Shops and Locomotive Terminals recommends under the heading of "Repair Tracks" as follows: "These tracks should be * * * spaced alternately 16 ft. and 24 ft. center to center," and so forth.

Now if that clause in recommendation 1, the distance from center line in car shops, applies to recommendations 2 and 3, then there would appear to be no conflict. Possibly there is no conflict with recommendation 2 in any event, but in recommendation 3, it says: "The distance center line to center line of repair tracks that

do not have a material track between them should be not less than 18 ft.," and it conflicts with the existing recommendation in the Manual.

Mr. Williams: The recommendation as it now stands in the Manual, I understand, applies to yard tracks only, while in this case it was only intended that the spacing should apply to repair tracks under cover or in freight car shops. It was felt that the heading, "Recommended Practice for Freight Car Repair Shops," would cover that. I remember that that was discussed in some of the committee meetings, and it was disposed of in this way. It was not intended that this shall be recommended practice for outside repair yards.

* * * The recommendations were unanimously carried.

(The report on Appendix B. typical layouts for storage and distribution of fuel oil, was presented by J. M. Metcalf, chairman of the subcommittee. *It was moved and carried that the conclusions in this report be accepted and printed in the Manual.*)

(The report on Appendix C, the ventilation of engine houses, was presented by L. P. Kimball, vice-chairman. The report was submitted as information only, not for publication.)

J. L. Pickles (D. W. & P.): I notice there is a recommendation for smoke jacks. Is there any reason for that? In the cold climates it eats up a lot of coal that should not be wasted.

Mr. Kimball: The reason for that is the use of the dampers and the fact that in practical operation they are not used as designed.

[The committee was excused with the thanks of the Association.]

Report on Signals and Interlocking

The report of the Committee on Signals and Interlocking submitted this year presented a voluminous amount of information on automatic train control and signals for highway crossing protection. In presenting its report on automatic train control, the committee outlined six important factors concerned with this question, confining itself this year, however, to a detailed report of but two of these, namely, the purpose of train control and historical data and the extent to which wayside signals may be omitted in train control territory. The report on signals for highway crossing protection consisted largely of excerpts and conclusions from papers presented at various societies and conferences during the past year. F. B. Wiegand has been chairman of the committee for the past two years.

F. B. Wiegand, Chairman

THE COMMITTEE submitted reports covering (1) Revision of Manual in Appendix A, (2) Automatic train control in Appendix B, and (3) Signals for highway crossing protection in Appendix C. The action recommended was that the changes in the Manual in Appendix A be approved and the revised version substituted for the present recommendation in the Manual; and that the report in Appendix B relating to automatic train control; and the report in Appendix C relating to signals for highway crossing protection, be accepted as information.

Committee: F. B. Weigand (P. & R.), Chairman; W. M. Vandersluis (I. C.), Vice-Chairman; B. T. Anderson (C. & O.), J. C. Mock (M. C.), H. S. Balliet (N. Y. C.), H. G. Morgan (I. C.), W. E. Borland (S. P.), F. P. Patenali (B. & O.), A. M. Burt (N. P.), J. A. Peabody (C. & N. W.), W. J. Eck (Sou.), F. W. Pfleging (U. P.), W. H. Elliott (N. Y. C.), W. M. Post (Penna.), G. E. Ellis (Aut. Tr. Control Com.), A. H. Rudd (Penna.), T. S. Stevens (A. T. & S. F.), J. V. Hanna (K. C. T.), E. G. Stradling (C. I. & L.).

Appendix A—Revision of Manual

The report contains various recommendations in reference to revision of the Manual so far as it relates to signals and interlocking.

Definitions

Page 465 of the Manual shows a portion of the A. R. A. Standard Code Rules. It is recommended that the present subject-matter be eliminated and the following references be substituted:

Definitions.
Block Signals.
Interlocking.
The Standard Code.
The American Railway Association.

Pages 466-467 and top of page 468 show a number of definitions of signal terms. It is recommended that the present subject-matter be eliminated and the following reference to Signal Section definitions be substituted:

Definitions for Technical Terms.
Manual of the Signal Section, American Railway Association.

Conventional Signs or Symbols for Signals and Interlockings

On page 468 reference is made to 13 R. S. A. plates of signs or symbols under Committee XI, Records and Accounts, pages 554-565. It is recommended that the reference be revised to read as follows:

Signal Symbols.
Manual of the Signal Section, American Railway Association.

Signals for Train Operation

It is recommended this subject-matter follow "Signal Symbols." That the subject-matter on pages 487 to 497 be eliminated and reference as follows be substituted:

Signs or Markers for Conveying Instructions to Enginemen and Recommendations.
Manual of the Signal Section, American Railway Association.
Train Order Signals.
Manual and Controlled Manual Block Signals.
Location of Manual Block Signals.
Indications Conferring or Restricting Rights.

The general practice of the present time on the larger

railroads is to handle trains by signal indications without the use of train order or manual block signals. It is therefore recommended that this subject-matter on pages 468, 469, 470, 471 and 472 be eliminated.

Division of Expense of Installation, Removal and Maintenance of Joint Interlocking Plants

The table on page 472 is out of date. It is recommended that this subject-matter be eliminated and the following reference to the Signal Section table be substituted:

Table of Interlocking Units and Values.
Manual of the Signal Section, American Railway Association.

Signal Indications and Aspects

On pages 473, 474, 475 is shown an abstract taken from "Signaling Practice" now in the Signal Section Manual. In order that the complete report may be used it is recommended that this subject-matter be eliminated and reference as follows be substituted:

Signaling Practice.
Manual of the Signal Section, American Railway Association.

Requisites of Switch Indicators

On pages 476 and 477 is shown subject-matter now in the Signal Section Manual. It is recommended that this be eliminated and reference as follows be substituted:

Switch Indicators.
Manual of the Signal Section, American Railway Association.

List of Findings, Conclusions, Standards and Specifications Contained in the Manual of the Railway Signal Association

On pages 477-486 is shown an index, as of 1920, of the Signal Section Manual. It is recommended that the index be brought up to date by substituting a new index as prepared by the committee.

Appendix B—Automatic Train Control

The report on automatic train control will have to be divided into several sections and for this purpose the following are used:

(a) The purpose of train control and historical data.
(b) Definitions.
(c) The effect of train control on train operation.
(d) The comparative control furnished by various types of train stop and train control devices.
(e) The effect on signal systems of installing train control.
(f) To what extent may wayside signals be omitted in train control territory?

Other subdivisions may be found necessary as the studies are continued.

The report submitted covered:

(a) The purpose of train control and historical data.
(f) To what extent may wayside signals be omitted in train control territory?

[An exhaustive report was presented by the committee outlining the functions as well as the limitations of automatic train control devices and a history of the development and tests of various systems that have advanced to the point of experimental installation, together with a history of governmental activities relating to the subjects. It included also a list of articles appearing in "Railway Signaling" from November, 1914, to June, 1924, inclusive, describing various systems of train control devices.—Editor.]

To What Extent May Wayside Signals be Omitted in Train Control Territory?

Interstate Commerce Commission Order No. 13413 states: "In prevailing practice the primary function of automatic train stop or train control devices is to enforce obedience to the indication of fixed signals; but the feasible operation of essentially similar devices used without working wayside signals may be regarded as a possibility." And in another part of the order: "We have decided not to limit by our order the installation of automatic train control devices to roads or portion of roads already equipped with automatic block signals, because we have no desire to discourage efforts to automatically control trains without the aid of fixed wayside signals. The statement, therefore, of the primary function of automatic train stop or train control devices recognizes the possibility of installing such a device without the use of automatic block signals."

Recognizing the possibilities of this proposition, the Pennsylvania made a trial installation on its Lewistown branch of a continuous induction train control system with wayside signals only at passing sidings where trains are required to stop and receive instructions; the spacing of the trains being accomplished without wayside signals. Following preliminary tests of this installation, the Atchison, Topeka & Santa Fe is now making a similar installation on its Illinois division in the territory specified in I. C. C. Order No. 13413.

Train control of the continuous induction type, wherein the indicator in the cab reliably shows conditions ahead and instantly indicates changes in such conditions, appears to be the only system so far produced which may be used safely as a substitute for fixed signals for spacing trains. It utilizes the track circuit together with a circuit superimposed on the track circuit, as the actuating medium. Impulses are picked up by induction coils on the locomotive and by means of vacuum tubes amplified so that they will operate a three-position relay on the locomotive which through proper contacts may give three indications by letters, "S," "R" and "A"—Slow, Restricted and Authorized Speed, or by colors red, yellow and green. Thus the track circuit indications are carried onto the locomotive, making it possible to locate the signal in the locomotive cab instead of along the wayside.

Various reasons have been advanced to show the necessity for wayside signals in connection with train control. These, together with analyses, follow:

1. To give sufficient advance information to properly handle train. Cab signal does not provide an indication that a train is approaching a caution signal. (By providing additional braking distance to allow the use of a delayed brake application, engineman can be given the equivalent of the advance information now received from wayside signals.)

2. To avoid the necessity of constantly observing cab indicator which would lessen observance of conditions ahead. (Experience proves that the flip of the cab indicator attracts the eye. In addition to this, audible indications can be given to attract the engineman's attention to any change in the visual indicators.)

3. To provide means for giving proper information where trains are diverted at interlocking plants. (Wayside signals should be used at such points.)

4. Wayside signals provide means for protecting trains when it is necessary to cut out the train control equipment on the engine. (If experience shows that failures are so frequent that wayside signals are necessary for this reason, train control will be a failure.)

5. To make it possible for engineman to have complete control of air brakes as long as he properly handles train. This will avoid undesirable application of the brakes. (Arrangement outlined in No. 1 takes care of this.)

6. To provide a stop indication ahead if an emergency application is required on account of obstruction of track due to wreck on adjoining track, switch opened ahead of train or other emergency that might set wayside signal at stop. (Cab indicators take care of this.)

7. To provide a check on proper operation of engine automatic control apparatus. (If train control is a success, such a check is not necessary.)

8. To provide markers—to define the locations where change of indications might ordinarily be expected. (Not needed except at stop points where wayside signals must be provided.)

9. To provide for making efficiency tests. (Not needed. Train control provides necessary check.)

10. In case of accident, the presence of wayside signal and its condition after the accident may provide evidence that the engineman is negligent. (No use except as a post mortem, and then of doubtful value.)

11. To assist trackmen in locating broken rails and signalman in maintaining signals. (Not of sufficient value to warrant additional cost of wayside signals.)

12. To prevent making engineman an automaton. (The required acknowledgment of every change to a more restrictive indication, which must be made to prevent unnecessary delay or a stop, is the preventive.)

13. To provide information for detoured engines not equipped cab indicators. (If trains not equipped with train control are detoured at very frequent intervals and cannot be protected in some other way, wayside signals would be a necessity.)

While an automatic signal may be made to display "Stop," ordinarily its most restrictive indication is "Stop and Proceed." After a train has stopped it may proceed "running with caution expecting to find a train in the block, broken rail, or switch not properly set." As a speed control enforces the slow speed command, the stop seems unnecessary. If the stop at an automatic signal is unnecessary, then the automatic block signal would seem to be unnecessary, as the cab indicator tells the story.

It seems logical that the "Stop" indication would have to be provided by a fixed wayside signal to mark the point where it is necessary to hold a train until it is desired that it proceed. The "Proceed" indications can be given by the cab indicator, making the automatic wayside signal unnecessary.

Where wayside signals are used with train control, there are conflicts in the indications as follows:

(a) Automatic signal indicates "Proceed prepared to stop at next signal." Cab indicator shows "A" or "green light" (a more favorable indication) until train reaches signal, then "R" or "yellow light," and if the block in advance clears, cab indicator changes to "A" or "green light," although fixed signal just passed showed "R' or "yellow light."

(b) Automatic signal indicates "Proceed." Cab indicator indicates "A" or "green light." After train passes fixed signal, wreck occurs ahead, or switch is opened. Cab indicator changes to "S" or "red light," although fixed signal just passed indicated "Proceed."

(c) Approaching a curve having a speed restriction, cab indicator shows "R" or "yellow light"; fixed signal indicates "Proceed."

There are no installations of an intermittent type of train control without wayside signals. Train control of the intermittent type is not affected by a change of conditions while a train is between roadside indicating points, therefore, an indication in the cab carried from one indication point to another may be misleading.

Conclusions

With train control of the continuous type, the only wayside signals required are those located where trains may be required to stop until authorized to proceed or where it is desired to give orders or instructions.

Appendix C—Signals for Highway Crossing Protection

This report was largely composed of excerpts from abstracts of papers presented at the conference under the auspices of the National Association of Railroad and Utilities Commissioners, Chicago, May 1, 1924, by W. D. B. Ainey, H. A. Rowe and C. L. Bardo, and proceedings of previous meeting of the commissioners held in Miami, Fla., December 4 to 7, 1924; a paper read to the Western Society of Engineers, Chicago, May 19, by R. H. Ford; and other excerpts from various public documents—all of which are worth reading.

The conclusions are an extract from a letter from the President of the United States to the conference of May 1, which is so terse and accurate that it might well be received as covering the entire subject, and the remainder of this report regarded simply as supporting data.

Conclusions

"The ideal, of course, is complete separation of grades of railroads from highways, and as the one and final solution of the problem it should be accomplished as soon as possible. It is realized, of course, that complete separation is beyond realization in the lives of those living. This for two reasons—first, the magnitude of the task; second, the utter inability to pay the necessary cost.

"Undoubtedly much can be accomplished immediately by surrounding highway crossings with proper safeguards, giving suitable notice of the approach of trains and awakening in the mind of the traveler a full sense of personal responsibility for careful action in approaching and passing over railroad crossings."

[The part of the report was followed by a series of detailed extracts from the proceedings and papers mentioned above.]

Recommendations of the Signal Section of the A. R. A.

The Signal Section's contribution to this subject is the following requisites unanimously approved at the stated meeting in September, 1924, and to be presented at its meeting in Chicago for approval and submission to letter-ballot:

1. **Aspect.**—An electrically or mechanically operated signal used for the protection of highway traffic at railroad crossings shall present toward the highway, when indicating the approach of a train, the appearance of a horizontally swinging red light and or disc.

2. **Location.**—The railroad standard highway crossing sign and the signal shall be mounted on the same post.

3. **Operating time.**—Automatic signal devices used to indicate the approach of trains shall so indicate for not less than 20 seconds before the arrival of the fastest train operated over the crossing. (Note—Local conditions may require a longer operating time; however, too long an operation by slow trains is undesirable.)

Flashing Light Type

4. **Height.**—The lamps should preferably be not less than 6 ft. nor more than 9 ft. above the surface of the highway.

5. **Width.**—The two lamps shall be mounted horizontally 2 ft. 6 in. centers.

6. **Flashes.**—Lights shall flash alternately. The number of flashes of each light per minute shall be 30 minimum, 45 maximum.

7. **Hoods.**—Lamp units shall be properly hooded.

8. **Range.**—When lamps are operated at normal voltage, the range, on tangent, shall be at least 300 ft. on a clear day, with a bright sun at or near the zenith.

9. **Spread.**—The beam spread shall be not less than 3 deg. each side of the axial beam under normal conditions. This beam spread is interpreted to refer to the point at the angle mentioned where the intensity of the beam is 50 per cent of the axial beam under normal conditions.

10. **Lenses or roundels.**—Size shall be 5⅜ in. minimum; 8⅜ maximum.

11. **Transmission values (for red lenses and roundels).**—Based on A. R. A. standard scale, should be 160 to 220 where plain cover glass with reflector is used; 220 to 275 where signals are used without reflectors or where the ribbed spreadlite lens is used in front of the reflector.

12. **Lamp.** Six to eight-volt automobile type bulb, gas-filled, and not exceeding 15 watts, shall be provided.

13. **Short range indication.**—Signal shall display a satisfactory short range indication.

14. **Peep holes.** Peep holes may be used.

Wig-Wag Type

15. **Length of stroke.**—Length of stroke is the length of chord which subtends the arc, determined by the center of the disc in its extreme positions, and shall be 2 ft. 6 in.

16. **Disc.**—Size and painting of disc shall be as shown on A. R. A. Sig. Sec. 1553.

17. **Number of cycles.**—Movement from one extreme to the other and back constitutes a cycle. The number of cycles per minute shall be 30 minimum, 45 maximum.

The immediate work of the Association is the adoption of a recommended warning sign to be placed at the crossing and to which the signal can be attached.

The American Railway Association has already recommended and many roads and states have adopted the circular approach sign with the black cross and letters "RR," black and white diagonal striping on crossing gates, and the circular stop sign by day in the hands of

the watchman, and the red light on gates and used by the watchman at night.

Therefore, with the sign at the crossing standardized, and the signal indicating the approach of trains standardized, the only thing remaining would be a sign and lights to indicate the stop at crossings where such stop would not seriously delay the vehicular traffic, where such stop is required by law, and at crossings which the Public Service Commission has authority to designate as "extra-hazardous."

With the standards established, there would still exist the necessity for legislation requiring their observance, enforcing of this legislation and the education of the people.

The American Engineering Standards Committee will some time make a report on the Code on Colors for Traffic Signals, which is along the lines indicated in the various suggestions embodied in this report, and which it is hoped may be universally adopted.

Discussion

[The report of the committee was introduced by F. B. Wiegand, chairman, the reports of the subcommittees being presented by their respective chairmen. B. T. Anderson (C. & O.) submitted the report on the revision of the Manual and *moved that the revisions be adopted. The motion was carried.* The report on automatic train control was next presented by J. A. Peabody (C. & N. W.).]

President Ray: Last year, you will remember, the Association made a special request of this committee to give us something on automatic train control. Now it has come through in fine shape. It has furnished a lot of valuable information to us and it is well worth our consideration.

J. L. Campbell (S. P.): I wish personally to express my appreciation to the committee for this very interesting and valuable report on automatic train control, and I am quite sure that I voice the sentiment of the Association in that particular. The Committee on Signals and Interlocking is an important committee of this Association. The American Railway Engineering Association covers the whole field of railway engineering, of which signaling and interlocking and automatic train control are a part. Consequently, this committee will continue to serve a useful purpose in this Association because the Manual of the Association should cover the whole field of railway engineering and should not be minus the recommended practices as to signaling and interlocking and the development of automatic train control . This committee can serve as a point of contact with the Railway Signal Association, which is the Signal Section of the American Railway Association. It does not follow that the committee need undertake to duplicate the work of the Railway Signal Association, but if in its wisdom it sees fit to bring to this Association the results of the work of the Railway Signal Association with the recommendation that it is material suitable to go into our Manual, I think the Association will be glad to receive it and the Railway Signal Association will receive proper credit as being the originator of the work. It is very important that this committee and its work in this Association be continued so that our Manual will be complete in every particular. Again I wish to thank the committee. (Applause.)

[The other sub-committee reports were presented and received as information without discussion following which the committee was excused with the thanks of the Association.]

Report of the Committee on Water Service

The Committee on Water Service presented progress reports covering a number of subjects, one of which, the possibilities of the use of hydraulic rams for railway water supplies, while new to many, suggested opportunities for economies where conditions are favorable. The committee presented a report on the value of water treatment, giving costs of operating and maintaining locomotives using treated water compared with these costs where untreated water is used. Other progress reports treated of the pitting and corrosion of boiler tubes and sheets, the comparative merit of lead and its substitutes for joints in cast iron pipe, and the relative economy of the different methods of pumping water. C. R. Knowles has been chairman of the committee for two years, and a member for 9 years.

C. R. Knowles
Chairman

THE COMMITTEE presented certain revisions of the Manual pertaining to rules for water department employees and for the care and operation of water stations as developed in joint committee work with the Committee on Rules and Organization for inclusion in the latter's report. Final reports were presented for the information of the Association on three subjects as follows: Lead as compared with substitutes for joints in cast iron pipe, which was presented in an Appendix E; the possibilities of the use of hydraulic rams for railway water supplies, as presented in an Appendix G, and the relative economy of different methods of pumping water, as submitted under Appendix H. The committee also submitted as information progress reports on drinking water supplies on trains and premises of railways, in Appendix D; on the pitting and corrosion of boiler sheets, in an Appendix C and on the value of water treatment, in Appendix D.

Committee:—C. R. Knowles (I. C.), chairman; R. C. Bardwell (C. & O.), vice-chairman; W. M. Barr (U. P.), Dr. S. C. Beach (I. C.), O. W. Carrick (Wab.), R. W. Chorley (Penna.), W. A. Christian (Chicago), R. E. Coughlan (C. & N. W.), J. H.

Davidson (M. K. & T.), J. M. Fitzgerald (C. of J.), C. H. Fox (C. P.), B. W. DeGeer (G. N.), E. M. Grime (N. P.), J. P. Hanley (I. C.), W. H. Hobbs (C. & E. I.), C. P. Hoover (Columbus, O.), C. H. Koyl (C. M. & St. P.), P. M. LaBach (C. R. I. & P.), E. G. Lane (B. & O.), W. B. McCaleb (Penna.), M. E. McDonnell (Penna.), E. H. Olsen (A. T. & S. F.), A. B. Pierce (Sou.), O. T. Rees (A. T. & S. F.), H. H. Richardson (M. P.), H. L. Roscoe (K. C. S.), T. D. Sedwick (C. R. I. & P.), D. A. Steel (*Railway Age*), C. P. VanGundy (B. & O.), H. W. VanHovenberg (St. L. & S. W.), F. J. Walters (N. C. & St. L.), F. D. Yeaton (C. M. & St. P.)

Appendix C—Pitting and Corrosion of Boiler Tubes and Sheets

Recently, experiments were made for your sub-committee, which appear to throw additional light on the influence of electrolytes on corrosion. It was found that the hydrogen ion concentration of water is changed by the addition of sodium sulphate and sodium chloride. These results indicate that lack of homogeneity of the metal is not essential to corrosion. Further hydrogen ion tests were conducted with sodium sulphate and sodium chloride solutions with varying amounts of caustic soda and sodium carbonate. Parallel "beaker" tests on the corrosion of steel were conducted with these solutions. These results indicate that pitting and corrosion can be prevented by caustic soda.

The committee considers excess treatment with caustic soda the most available method of preventing pitting and corrosion which has so far been developed.

The effect of alloying elements such as copper, has been considered and proof has not been found that such alloys as are commercially available and adaptable for boiler construction corrode less rapidly than standard plain carbon steel or wrought iron sheets and tubes. The influence of protective coatings has been considered, and nothing has been found which can now be considered effective.

Appendix D—The Cost of Impurities in Locomotive Water Supply and the Value of Water Treatment

A very moderately impure water, of say 12 to 15 grains per gallon of incrusting solids, is likely to injure the operation of a road to the amount of $2,000 per locomotive per year; and the cost rises with the increase of impurities to practically prohibitive figures at $20,000 to $25,000 per locomotive per year.

The Wabash, with 2,489 miles of road and 648 locomotives, converts its 15-grain-per-gal. hard water into soft water by 113 water treating plants using soda-ash only, and reports saving of $1,647 per locomotive per year. The value of dependable train movement has not yet been evaluated nor even approximated, but experienced operating officers would probably estimate it as high as the sum of all the other items.

The Chicago & Alton, with 1,052 miles of track, 341 locomotives, and 51 water treating plants using soda-ash only, installed between March and November, 1922, reports 32 per cent reduction in boiler repairs, 6 per cent in fuel, and other reductions, which make an annual total of $354,464, which can be vouched for, with probability that the total will reach $657,000, or an average of $1,927 per locomotive per year.

On the Hocking Valley, the division of 121 miles from Columbus, Ohio, to Toledo has seven treated water stations, and reports that flues and fireboxes now last three times as long as with untreated water averaging 22 grains per gal., that scale is almost eliminated, and that there is a 20 per cent reduction in fuel. From the data given it is estimated that a minimum saving of $2,500 per year per locomotive is made on that division.

Missouri-Kansas-Texas

The waters of the M. K. T. are not bad as western waters go, averaging only about 14 grains per gal. of incrustants, but illustrate what damage results from a small amount of impurity. On this road there was one water treating plant in operation in 1920, two in 1921, nine in 1922, and 80 plants were constructed during 1923, making a total of 89 water treating plants in operation in 1924 for a total of 159 water stations equipping 3,202 miles of railroad.

The total investment in water treating facilities was $281,843. On a passenger-car-mile and 1,000-gross-ton-mile basis, the fuel performance for the first seven months of 1924 was 10.6 per cent better in passenger service and 16.4 per cent better in freight service than for the corresponding months in 1923. This represents a saving of approximately $285,000 for the system for the seven months' period, and while entire credit for this saving is not claimed for water treatment, yet the improvement in water was doubtless the most important factor in making it possible. Leaky flues and fireboxes are getting very scarce and boiler failures on the road have been reduced from one every 72,185 miles to one every 317,513 miles, these few being due to pitted flues. A continuous passenger run of 869 miles is made regularly from Franklin, Mo., to San Antonio, Tex., and some of the freight runs have been doubled in length.

The only district on the system which has been equipped for one year is the "Texas Central," running northwestward from Waco to Rotan, which is the worst district on the road, the waters averaging 18 grains per gal. of incrustants, of which 10 grains is carbonate and 8 grains sulphate. It is estimated that on this district the saving in boiler work and material amounts to $2,500 per engine per year, and that the saving in fuel and reduction in transportation expenses due to better engine performance will bring this saving to at least $3,000 per engine per year. Perhaps by next year we can get a similarly inclusive report for the system as a whole.

Illinois Central

This railroad has provided clean soft water on its Iowa division, and the report of savings is noticeable because it is taken from the annual summary of the railroad, because it includes the saving in oil, overtime, enginehouse expense and supplies, and because it presents for comparison the corresponding record of an adjoining division which had no change in waters.

On the Illinois Central the Iowa division and the St. Louis division have each approximately 520 miles of track. The waters on the Iowa division average 24 grains per gal. of incrusting solids, and on the St. Louis Division only 7 grains. In January, 1922, the Iowa division was fitted with lime-soda water treating plants to the extent of 54 per cent of the water used, while the remaining 46 per cent of the water was temporarily treated with soda-ash or boiler compound in the boilers. On the St. Louis division no change was made in the waters.

At the end of two years, January, 1924, comparison was made of the cost of operating and maintaining locomotives for two years before the installation of water treating and the two years after. The two years before were averaged, and the two years after, and it was found that the cost of operating and maintaining locomotives on the Iowa division had decreased with the use of treated water $3,536 per locomotive per year. But when similar comparison was made for the St. Louis division it was found that the cost of

operating and maintaining locomotives had decreased only $95 per locomotive per year.

The safety and the value of this form of report rest on the comparison with an adjoining division where it is reasonable to suppose that changes in wage rates and in amount of business had similar effects on the cost of operating and maintaining locomotives.

It should be noted also that only 54 per cent of the water of the Iowa division was completely treated, though the betterment is distributed among all the locomotives of the division and we are not advised what proportion of the locomotives received the treated water. It is certain that if the savings had been credited to the engines of the treated districts only, the results per engine would have been much higher. This division is now completely treated, and next year we can probably present more exact data.

CHICAGO, MILWAUKEE & ST. PAUL

The Chicago, Milwaukee & St. Paul reports the result in three cases of water treating. The first is that of the switch engines located at Montevideo, on the main line in western Minnesota, where the raw water is taken from a dirty stream averaging 20 grains of incrusting solids, and sometimes organic matters, and where a lime-soda water treating plant was installed a few years ago. The following statement of savings in repairs and coal is computed from the detailed report of the local boiler foreman who had worked with the oil water and the new.

SAVINGS PER SWITCH ENGINE PER YEAR

Working flues, $8.40 per week	$450 per year
Renewing arch tubes, $36 per month	432 " "
Renewing flues	250 " "
New firebox at $2,700 every 1½ years	1,800 " "
One ton of coal per day at $4	1,200 " "
	$4,132

The second report from the Chicago, Milwaukee & St. Paul is the result of having treated 75 per cent of the waters of the Sioux City & Dakota division, mostly in South Dakota. The untreated waters averaged 50 grains per gal. of incrusting solids and were of a kind very destructive of boiler tightness.

The water treating plants were built during 1921, and the average benefit to the locomotives in 1921 over 1920 is estimated at $2,000 each. The annual statements of operating statistics for the division, show an improvement of $4,443 per locomotive per year as the average of 1922-23 over 1921. The average of 1920-21 is believed to be $1,000 higher than the figures for 1921, and that the improvement due to treating 75 per cent of the water of this division may be conservatively set at $5,443 for each locomotive of the division. A similar report for the Iowa division of the Chicago, Milwaukee & St. Paul shows the changes in costs not due to water treatment. The comparatively small lessening in cost of $525 per engine on the Iowa division is the justification for believing that the additional saving of $5,000 per engine on the S. C. & D. division was due to the better water.

The third statement of the Chicago, Milwaukee & St. Paul is derived from a report made two years ago of the result of complete water treating on an engine district of 130 miles on the Iowa and Dakota division also mostly in South Dakota. Here all the waters were treated, and account is taken of at least a portion of the remarkable economies in operation which followed the change in waters. The original report gives the total saving as $9,000 per locomotive per year and considers it an absolute minimum. On these two divisions, no charge is made for the boiler failures on the road which in winter nearly paralyzed traffic.

EL PASO & SOUTHWESTERN (SOUTHERN PACIFIC)

The highest valuation is fixed by a report from the El Paso & Southwestern, made by J. L. Campbell, formerly chief engineer, concerning a strip of 128 miles of road on which mountain water was substituted for very bad deep well water, with a saving of $2,700 per mile of road per year. The number of engines on that strip of road was not ascertained but the saving is estimated at approximately $20,000 per engine per year. This last case illustrates what can be done by the substitution of the best water for nearly the worst, and shows the justifiable expense for the purpose of keeping railroad locomotives always ready for service.

Appendix E—Lead as Compared With Substitutes for Joints in Cast Iron Pipe

The substance that has been in most general use for calking pipe is lead, others being cement and composition. Wood and leadwool has been used in a limited way only and for special purposes.

Lead has been in use since the adoption of this kind of pipe connections and is still the most favored material. It can be poured in all kinds of working conditions and the joint is ready for immediate use. It is the most flexible, malleable and least rigid of the three materials. Leaks can be stopped by recaulking while the line is under pressure.

Cement, next to lead, is the oldest sealing material and its use is gradually increasing. It makes the most rigid and least flexible joint of the three materials (after complete setting of the cement in the entire joint). It is necessary to let the joint set 48 hours before being placed in service. It should not be used in freezing weather nor in wet places. It is not suitable to use where there is apt to be continual and excessive ground movement or longitudinal pipe travel. However, it has been successively used for lines that run parallel with and underneath main line tracks. There should be at least four feet between base of tie and top of pipe, and, if possible, there should be no joints under the ties. The material will not squeeze out of joints. It makes a connection so strong that the pipe generally breaks before the joint opens. The complete joint generally costs less than lead.

The composition is the newest of pipe joining materials. Its use is gradually increasing. It makes a joint less flexible than lead but more flexible than cement. It is more rigid than lead and less rigid than cement. It will not squeeze out. It has been used successively along tracks and under them and pipe joints under ties should be avoided. There should be at least four feet between base of tie and top of pipe. The complete joint generally costs less than lead.

Appendix G—Hydraulic Rams for Use in Railway Water Service

The hydraulic ram is primarily a device by which the momentum of water flowing by gravity through a pipe is utilized to lift a portion of itself or other water through another pipe to an elevation greater than the source of supply.

In considering the use of hydraulic rams for railroad water supplies, certain limiting conditions as regards the source of supply must first be satisfied. Unless the source under consideration will afford a sufficient quantity of water at all seasons of the year to meet the requirements at the particular station, and also furnish the waste water required for the operation of the ram, and unless a suitable difference in elevation

exists in the source of supply, or can be created at a reasonable expense, hydraulic rams cannot be used for railway water service.

Probably the most important features in the installation of a ram are the size and length of the drive pipe or supply line. Inasmuch as the function of the drive pipe is to create momentum in the column of water, it should permit of a rapid acceleration of the water. For this reason bends, changes in section or size, and other obstructions should be avoided as far as possible and where bends are necessary it will be found more satisfactory to make a long easy bend in the pipe line than to use standard short radius fittings. If strainers are used at the inlet, they should be of sufficient size and length to reduce the loss of head at entrance as much as possible. In extremely cold climates the use of these strainers may prove objectionable, due to the formation of needle ice.

The proper length of drive pipe is the first consideration in setting a ram. However, an account of the complicated laws governing the rate of waste valve closure, and the laws of water hammer, the problem does not admit of simple mathematical calculation. These lengths have, therefore, usually been made in accordance with manufacturers' empirical rules and even here there is a very considerable lack of uniformity in the method of determining the proper length. Where rams are installed in batteries, separate drive pipes should be laid to each ram. It will usually be found expedient to place a quick opening gate valve in the drive pipe close to the ram.

The ram itself should preferably be set in a pit at the proper drive pipe distance from the source of supply, with suitable provisions for draining the pit of the waste water. In the event conditions are such as to prevent constructing the pit at the drive pipe distance from the source, it may be placed at some other convenient point further away, provided a stand pipe or small auxiliary reservoir is constructed in the pipe line at the critical distance from the ram. As the ram will operate continuously, suitable overflow provisions must be made at the roadside storage tank to take care of this condition.

Inasmuch as each size of ram requires a minimum amount of water for its successful operation, the proper size to use in any particular installation must be determined from the available amount of water at the source.

A check of 20 installations of hydraulic rams, which have been in service at water stations on American railroads from 2 to 15 years, indicates that this type of equipment will give satisfactory results at low cost where conditions are favorable. By taking advantage of the low operating head and short drive pipe it is often possible to eliminate a long and costly gravity line. The operating charges are nothing, the maintenance is low. The wearing parts are few and easily repaired. The only trouble mentioned arises from the stud bolts working loose. No trouble has been experienced with freezing, even on the extreme northern roads. About the only attention found necessary has been an annual or semi-annual inspection by water service repairman. Where the installation has been properly made it is adequate, dependable, and a near approach to fool proof.

Conclusions

The hydraulic ram has been found to make a very serviceable and economical installation for railway water supply where local and individual conditions will permit the workable application.

It is recommended that installations of this type be given greater consideration where operating conditions are favorable.

Appendix H—The Relative Economy of Different Methods of Pumping Water

A summary of the replies received from questionnaires showing in condensed form the cost of pumping per 1,000 gal. and the cost per water horse power hour under each of the power methods mentioned indicates that the oil engine is the cheapest method for pumping water. There are many variable conditions to be encountered in railway water service, however, and for this reason any hard and fast recommendations for one method of pumping only would not be advisable in all cases, and we suggest that railroads contemplating water station construction should make a comparative estimate for each job contemplated which should show the annual cost per 1,000 gal. for furnishing water under each of the four methods now being considered in order to decide on which method they should use.

City Water

The advantage of a city supply is that the railroad escapes the interest, depreciation, insurance, taxes and maintenance charges on a sometimes very expensive plant as in the case of developing a reservoir supply or installing long pipe lines. On the other hand care should be exercised that the city supply is reliable and will not fail during dry seasons, as the railroads have had considerable trouble with some cities which depend on a reservoir or well supply, for as soon as this supply becomes low the railroad service is the first to be shut off and the railroads then spend considerable money in hauling water or erecting temporary water stations. The rates paid for city water by railroads reporting to us for stations using in excess of 1,000,000 gal. per month varied from 6.3 cents to 18.7 cents per 1,000 gal.

Steam Pumping Stations

The majority of railroad pumping stations are steam operated because the steam plant was installed before oil or electric pumping units were developed. Some of these plants have been replaced by oil or electric plants and as the remainder wear out or become inadequate to supply sufficient water we believe that the installation of oil or electric plants will show a decided saving, but suggest that the comparative estimates mentioned heretofore be used to check this statement. The cost of pumping at steam stations reported to us varied from 2 cents to 8.8 cents per 1,000 gal. and from 4.4 cents to 21.4 cents per water horsepower hour for fuel only with a corresponding increase in the cost of both units when labor, supplies, interest and depreciation costs were included.

Electrically Operated Pumping Plants

Electricity is a convenient source of power for pumping and when an electric motor directly connected to a centrifugal pump is used, it has the advantage of requiring less floor space and consequently less expensive housing than oil or steam plants. As a rule no saving is made in the use of electricity over coal considered as power only; the saving in the electric method of pumping occurs when pumpers can be dispensed with by the use of automatically controlled electric pumps.

The electrically operated stations on which reports were received showed that the cost of pumping varied from 0.75 cents to 3.6 cents per 1,000 gal. and from 2.5 cents to 13.5 cents per water horsepower hour for current only, with a corresponding increase in both units when labor, supplies, interest and depreciation were included. On account of the extension of power lines by the public service companies the availability of current of a dependable character at reasonable rates at iso-

lated railroad pumping locations will be increasing and we suggest railroads planning water station construction figure on the use of electricity by the comparative estimates heretofore mentioned.

Oil Engine Operated Pumping Stations

The oil engine now used at pumping stations is a development of the gasoline engine, which development was brought about the increasing cost of gasoline which made its use in stationary power plants prohibitive. The oil engine of the semi-Diesel type manufactured in this country has only recently passed out of the experimental stage. There are now some dependable oil engines on the market and this power has been found satisfactory for pumping water, but the installation of duplicate units at important stations is recommended, as this is the best way of carrying repair parts and providing against interruptions to service. The use of a small air compressor for starting oil engines of 25 hp. and over is recommended. This compressor is usually operated by a direct connected kerosene engine of 1½ to 3 hp. and makes a convenient method of starting the larger engine. This starting equipment is usually sold by the oil engine manufacturer. The oil engine has the reputation in some quarters of being very expensive as regards maintenance costs. This, however, is not necessarily the case.

The committee's investigation indicates that the maintenance of oil engine stations is less than on steam stations and about the same as the maintenance of electrically operated stations when all the stations are of similar horsepower and operating under similar physical conditions.

The cost of pumping at oil engine stations as reported varied from 0.42 cents to 1.1 cents per 1,000 gal. and from 0.74 cents to 3.3 cents per water horsepower hour for fuel oil only, with a corresponding increase in both units when labor, supplies, interest and depreciation were included.

Conclusions

(1) The committee has found that fuel oil is the cheapest power method for pumping water, electricity with automatic control the next cheapest, and steam and electricity with pumpers in attendance the most expensive.

(2) The economy in the lower power cost of fuel oil may be offset in some instances by decreased cost of attendance where it is practicable to decrease the number of pumpers by installing automatically operated electric pumps.

(3) Where water station construction is contemplated and it is necessary to decide on the relative economy of city water, or the use of an oil, steam or electric pumping station, a comparative estimate should be made showing the annual cost of furnishing water per 100 gal. under each method. In this estimate proper allowance should be made for all local conditions affecting the operation and maintenance of the station.

Discussion

[The report was presented by C. R. Knowles, chairman, who asked A. B. Pierce (Sou.) to represent the sub-committee on drinking water.]

Mr. Connelly (U. S. Public Health Service): The Public Health Service has derived a considerable amount of help both from this committee and from the joint committee of the A. R. E. A. and the A. R. A. It is hoped that we may continue to enjoy the co-operation that we have had in the past. There are many subjects allied to sanitary engineering which are not directly in the field of water supply which the public health service would like to see considered by the American Railway Engineering Association such as mosquito control, rodent control in the prevention of the spread of plague and other things, and it is hoped that the association may see fit to take up some of these questions along with water supplies.

Chairman Knowles: The next report is Appendix C, Pitting and Corrosion of Boiler Tubes and Sheets. I will ask Mr. Bardwell to present the report.

R. C. Bardwell (C. & O.): The factor having a most important bearing on the subject of corrosion, investigated during the past year, was the subject of over treatment with caustic soda. A formula has been developed for the practical prevention of corrosion in locomotive boilers, which calls for the over treatment with caustic soda. This is a flat contradiction of the recommendation of some authorities who claimed that it causes brittleness of the steel. This effect has not been noted in any way whatever in locomotive boilers, and the sub-committee feels that it has no bearing on the subject and it should be disregarded. For the present it is the recommendaion of the committee that to retard pitting and corrosion, the water should be over treated with caustic soda.

Chairman Knowles: The report of the sub-committee on the cost of impurities in locomotive water supply and the value of water treatment will be presented by Dr. Koyl.

Dr. G. H. Koyl (C. M. & St. P.): Fifty years ago the Master Mechanics' Association made a three-year study of the average cost of maintaining and operating locomotives in what we call good water territory such as there is in the mountains, and the cost of operating locomotives in what we call bad water territory, which is the ordinary country of the prairies and wherever there is hard water. That is still the best method of determining the cost of impurities in locomotive water. The figure deduced at that time ,applying only to the cost of fuel and the cost of repairs, was $750 per locomotive per year. Since that time we have begun methods of treating these waters to reduce their unsuitability as far as possible, and we find that a pound of scale in the boiler costs, with present prices, 13 cents. This is quite accurate if the waters which the locomotive takes are all of approximately the same class, all hard waters. But if the locomotive passes over a division taking some hard waters and some soft waters, the soft waters loosen the scale, the boilers begin to leak and then the influence of the leaking on the coal is so great that the 13 cents no longer is enough to account for the damage done.

Where water has been treated we find, if the water is comparatively simple, say 14 or 15 grains of limestone per gallon, the improvement in operating and maintaining the locomotives due to the treatment of the water amounts to approximately $1,600 per year per locomotive. As the waters get worse the cost of operating them without treatment increases, the value of water treatment increases and we reach figures applying to repairs, fuel, etc., of some $4,000 per locomotive per year. If we include also, the improvement in the operating of the division we are justified in doubling these figures and have the evidence to prove that the improvement amounts to some $8,000 per locomotive per year.

[Dr. Koyl then outlined the tabulated results reported by a member of the railroads to show the savings effected by water treatment. Following the presentation of this part of the report, D. A. Steel, *Railway Age*, presented a written statement criticizing that part of the report relating to the results obtained on one division of the Illinois Central (on which water is treated) in comparison with another division on which raw water is used. His contention for this criticism was that the statistics of locomotive operating costs cited embodied other factors of influence than the character of water used on the two divisions and that therefore the committee was not warranted in ascribing the differences in cost so largely to the difference in the character of the water.

Chairman Knowles: Not having had the opportunity

of reading Mr. Steel's paper, I really could not discuss it at length, even if time would permit. The committee has done an enormous lot of work on this subject. They produced these figures, and after having gone to the trouble of producing them, they presented them to the association for information. There is nothing in the report that would lead one to believe these figures ought to be accepted as final.

R. M. Coburn (Penna.): This is about the most important subject that we have and something we engineers can do for the good of the railroads more than almost anything else. It takes figures and convincing demonstrations to make the ordinary operating officer see what we can do for him in this way. I have been very much interested in the report, and we appreciate that it has been an enormous amount of hard work. I think the information is very valuable. Mr. Steel's contention and information adds considerable value to the report.

[Chairman Knowles then presented the report in Appendices E, F and G which were received as valuable information.]

Chairman Knowles: The next report is under Appendix H, the relative economy of different methods of pumping water. This report is presented for information.

H. M. Lull (S. P.): I would like to inquire whether the conclusions drawn in this report are intended to apply to all kinds of wells, that is, shallow, deep and under different pumping stations, or only to apply principally to shallow pumping for low head. It seems to me there is some question about it applying to pumping wells 500 to 1,000 ft. deep.

Chairman Knowles: The conclusions as presented by the committee are drawn largely from the reports or rather summary of tests of the different methods of pumping, and they are merely general statements and not intended to cover any particular condition. These conclusions are necessarily more or less general.

(The committee was dismissed with the thanks of the association.)

Report on Iron and Steel Structures

The Committee on Iron and Steel Structures submitted a number of revisions of the Manual which dealt with the general specifications for steel railway bridges and the removal of certain portions of the Manual now nullified by the adoption of the general specifications for the erection of steel railway bridges. In addition to the recommended revisions of the Manual the report included rules for the field inspection of existing bridges; a statement relative to the status of the specifications for steel highway bridges now before a conference committee of the A. R. E. A., A. S. C. E. and the association of highway officers, and brief progress reports on the behavior of bridge pins and on column tests. O. F. Dalstrom has been committee chairman for three years and a member for five years.

O. F. Dalstrom
Chairman

THE COMMITTEE presented a report covering: (1) Revision of Manual (Appendix A), (2) Specifications for Steel Highway Bridges Appendix B), (6)Rules for Field Inspection of Existing Bridges (Appendix C), (8) Tests and Study of the Behavior of Bridge Pins (Appendix D), (9) Column Tests (Appendix E). The last two were brief statements of progress.

The action recommended was: That the Revision of General Specifications for Steel Railway Bridges and the removal of certain portions of the Manual, beginning on pages 737 and 790, to be approved (Appendix A), and that Appendices B, C, D and E be received as information.

Committee—O. F. Dalstrom (C. & N. W.) Chairman; B. R. Leffler (N. Y. C.) P. S. Baker (Reading), J. E. Benhardt, (C. & E. I.), A. W. Carpenter (N. Y. C.), M. F. Clements (N. P.), R. P. Davis (U. of W. Va.), F. O. Dufour (La Fayette, Cal.), Thos. Earle (Beth. Steel Brg. Corp.), W. R. Edwards (B. & O.), G. H. Gilbert (Sou.), G. A. Haggander (C. B. & C.), H. J. Hansen (C. M. & St. P.), C. S. Heritage, (K. C. S.), Otis E. Hovey (Am. Brg. Co.), Reuben Hayes (Sou.), J. B. Huntley (C. C. C. & St. L.), P. G. Lang, Jr. (B. & O.), P. B. Motley (C. P. R.), Albert Reichmann (Am. Brg. Co.), A. F. Robinson (A. T. & S. F.), H. N .Rodenbaugh (F. E. C.), O. E. Selby (C. C. C. & St. L.), I. L. Simmons (C. R. I. & P.), H. B. Stuart (C. N. R.), P. B. Spencer (N. Y. N. H. & H.), G. E. Tebbetts (C. & O.), G. H. Trout (U. P.), F. E. Tureaure (U. of Wis.), F. P. Turner (N. & W.), J. A. L. Waddell (Con. Engr.), H. T. Welty (N. Y. C.), A. R. Wilson (Penna.), W. M. Wilson (U. of Ill.)

Appendix A—Revision of Manual

At the convention of 1924, the Association adopted certain changes in the General Specifications for Steel Railway Bridges, Part XI, Materials (a) Structural and Rivet Steel; and Part XV, Mill and Shop Inspection (Supplement to Manual 1921, Bulletin 267, July, 1924, page 51.) The purpose of these changes was to make the "Materials" Specifications agree with those of the American Society for Testing Materials. The changes recommended were adopted by both associations, with the exception that the footnote to Table II reading: "The weight of individual plates ordered to thickness shall not exceed the nominal weight by more than one and one-third times the amount given in this table," was not adopted by the A. S. T. M.

It therefore becomes necessary for us to offer Conclusion No. 1 for printing in the Manual as follows: Change the footnote, page 762 of the Manual 1921, page 55 of Bulletin 267 and page 22 of the pamphlet "General Specifications for Steel Railway Bridges, 1920, Second Edition," to read: "Specifications for material conform to A. S. T. M. Standards, Serials A7-24,

A27-24, and A48-18, except as to the footnote to Table II."

Attention has been called to the fact that it is not clear whether the term "Power driven rivets" in Article 38 of the General Specifications for Steel Railway Bridges includes field rivets driven by pneumatic hammers. In order to clear up this uncertainty and to remove an inconsistent discrimination against floor connection rivets, the committee offers Conclusion No. 2.

Revise Art. 38 by substituting for the sentence "The above mentioned values for shear and bearing shall be reduced 25 per cent for countersunk rivets, hand driven rivets, floor connection rivets, and turned bolts," the following:

The above-mentioned values for shear and bearing shall be reduced 25 per cent for countersunk rivets, hand driven rivets, and turned bolts. Rivets driven and bucked by pneumatically or electrically operated hammers are considered power driven rivets.

The adoption of "General Specifications for the Erection of Steel Railway Bridges," Supplement to Manual, 1921, Bulletin 257, page 67, and of "Classification of Railway Bridges," Supplement to Manual, 1921, Bulletin 267, page 41, nullifies the corresponding portion of the Manual, 1921. The committee therefore offers Conclusion No. 3.

Omit from the Manual, 1921, "Specifications for the Erection of Railway Bridges," page 737, and "Classification of Bridges for Operating Purposes," page 790.

Appendix B—Specifications for Steel Highway Bridges

The "Specifications for Steel Highway Bridges" was assigned to the committee in 1920. A sub-committee was appointed that year, and this sub-committee has been very active in the study of the subject and in the preparation of specifications.

During 1923 it was found that the American Society of Civil Engineers and the American Association of State Highway Officials also were preparing specifications for highway bridges. Arrangements were made through the offices of those associations for a conference committee of representatives from the A. R. E. A., the A. S. C. E., and the A. A. S. H. O. The American Institute of Steel Construction was invited to send a representative, and accepted. The duty of this conference committee was to compare the specifications prepared by the different associations, with a view to eliminating unnecessary differences and to bringing them all into harmony as nearly as practicable. This conference committee is still working on the specifications and will require at least another year to complete their work.

Appendix C—Instructions for Maintenance Inspection of Superstructures of Steel Bridges

Responsibility of Inspectors.—1. The instructions contained herein have been prepared for the guidance of inspectors engaged in the maintenance inspection of steel bridges. Inspectors will be held responsible for the execution of their duties in strict accordance with these instructions.

Communications.—2. Unless there are other instructions, copies of all communications sent to other officials shall be sent to the bridge engineer.

Drawings and Rules.—3. The Inspector shall familiarize himself with the standard drawings, rules and instructions covering maintenance of bridges.

Bridge List.—4. A complete list of bridges will be supplied to each inspector by the bridge engineer. This list will give the number and location of each bridge, type of superstructure and lengths of spans. In each case the number and location of the bridge given in the list shall appear on the inspector's report. The inspector shall report any difference between the bridge number given in the list and that at the bridge, and shall furnish such other information as the bridge engineer may require.

Emergency Reports.—5. In case a bridge is found to require immediate repairs for safety, the inspector shall notify, by the quickest means available, the proper division official and the bridge engineer, giving the bridge number, description, location, nature of defects, and temporary repairs required. The inspector shall send the above-mentioned officials, by first train, a complete report. If necessary the inspector shall stop traffic until emergency handling is given.

Reports.—6. A record of inspection of each bridge shall be made at the site on a form provided for that purpose. A written report shall be made as may be required, giving the inspector's recommendation for repairs needed and when they should be made to keep the bridge safe.

7. The report form accompanying these instructions shall not be taken as listing all the points requiring inspection. The points listed on this form are those most frequently found in need of attention. A complete detailed inspection shall be made of each bridge. Remarks on points not listed in the form shall be made on the blank portion of the form, or on separate sheets, using only one side of the sheet.

8. In the report form symbols shall be used as follows:

O.—Opposite items which do not apply to the bridge inspected.

O. K.—Opposite items which do not need attention.

X.—Opposite items needing repairs which merit special remarks. The numbers of items marked in this way shall be entered in the blank ruled portion of the sheet, with a concise but complete description of points which need attention, together with recommendation for repairs.

Every item on this form must be checked off.

Points to Be Examined.—9. The inspector shall examine the bridge as to the following points and others listed on the report form:

(a) Deck.

Size, spacing and depth of ties over flanges.

Uniformity of bearing.

Condition of timber as to defects and decay.

Number and size of defective ties, guard timbers and guard rails.

Fastenings of ties to flanges.

Fastenings of guard timbers and guard rails to ties.

Size of tie plates.

Condition of walks and railings.

Condition of planking between rails and between tracks.

Condition of refuge bays.

(b) Fire Protection. Description and condition of fire protection.

(c) Track.

Size and condition of rails, joints and fastenings.

Alinement of track and its relation to the steel structure.

Surface of track on bridge and on approaches.

Where track is out of line or surface, the report should show the location, amount and probable causes; also, the effect of creeping rail, if any, and preventive measures taken.

(d) Shims and Blocking.—Condition of all shims and blocking, giving description and location and making sketch if necessary.

(e) Bridge Seats.—Condition as to defects and cleanness.

(f) Anchors and Bearings.—Note whether the superstructure is fully and properly anchored to the masonry.

Note whether bed plates, rollers and pedestals are clean, are in right position and have full bearing.

Note any flaws or breaks in bearings.

(g) Expansion.—Note the clearance between expansion ends and masonry or adjacent spans; also any apparent movement of the masonry.

(h) Paint.—Condition of paint, noting date of last painting, number of coats and kinds of paint as stenciled on the bridge, and if spot painting or repainting is necessary.

(i) Straightness and Alinement of Members.—Condition of individual members as to bends and kinks; alinement of trusses, girders, floor members and towers. Note particularly adjustment of eye-bars and counters.

(j) Damage From Blows.—Parts damaged by blows from equipment, lading or floating objects; note location and extent of damage, and repairs necessary.

(k) Cracks and Breaks.—Note cracks and breaks, especially in floor connection angles, hangers, pin plates, and fillets of angles of flanges and posts.

(l) Pins and Pin Holes.—Condition of pins and pin holes as to wear and movement. They should be observed, if practicable, under traffic and the report should give location of pins as observed and approximate amount of movement or wear, if it can be determined.

(m) Rivets and Turned Bolts.—Note location and number that are loose, giving special attention to: Floor connections, splices in tension members, end stiffeners and laterals.

(n) Machinery of Movable Bridges.

1. Lubrication.—Note if a lubrication chart is posted and instructions followed, and if all moving parts have been kept

sufficiently lubricated. Report should show whether lack of lubrication is due to inattention or to inadequate facilities. If facilities are inadequate, give complete information with recommendation for improvement.

2. Gears.—Note condition of gears as to: Accurate meshing, fit on shafts, fit on keys, breaks, flaws and excessive wear, protection against falling objects and cleanness.

3. Bearings.—Note if bearings have proper linings and running fit; if shafting is accurately alined and if collars and thrust bearings are in adjustment. Note attachment of caps to bases and of bearing to supports; also line, fit and wear of trunnions and trunnion bearings.

4. Castings.—Condition of wedges, sheaves, locking devices, rollers, treads, etc., as to breaks or flaws which might cause breaks.

5. Cables.—Condition as to rust and excessive accumulations of hardened grease; also broken wires, broken strands and working clearances.

6. Clutches and Brakes.—Condition as to working conditions and cleanness.

7. Power Equipment.—As to condition for delivering the necessary power, and if properly maintained.

8. Mechanical Features.—As to operating conditions: Adjustment of balance wheels, adjustment of levers operating the wedges, entire turntable of swing bridges, rail locks and signal interlocking connections, navigation lights, clearances through a complete cycle of operation, safety devices, electrical and mechanical, and lightning protection of power plant and superstructure.

9. Operating Diagram.—Note if operating diagram is posted.

10. Record of Openings.—Note if a complete record is being kept of bridge opening and vessel movements, and of happenings affecting the interests of the railway company.

General.—10. Reports signs of overload or failure in any part of the bridge.

Observe the behavior of the bridge during the passing of live load, if practicable, and note excessive vibration, deflection and side sway.

Note attachments such as wires, pipes, etc., which may be detrimental to the bridge.

Report Form (First Page)

Name of Railway

..... Division Date Inspected.....
Bridge No..... Inspector .....
Description: Number, Lengths and Kinds of Spans.....

1. Number Board
2. Waterway
3. Highwater Marks
4. Deck
   - (a) Ties
   - (b) Guard timbers
   - (c) Guard rails
   - (d) Planking
   - (e) Refuge bays
   - (f) Hook bolts
   - (g) Guard timber bolts
   - (h) Guard rail fastenings
   - (i) Track alinement
   - (j) Track level
   - (k) Track fastenings
   - (l) Tie plates
5. Fire protection
6. Shims and blocking
7. Bridge seats
8. Anchors and bearings
9. Expansion
10. Paint
11. Straightness and alinement of members
12. Damage from blows
13. Cracks and breaks
14. Pins and pin holes
15. Rivets and turned bolts
16. Machinery
17. Vibration, deflection and side sway

Items requiring immediate attention.....
Items requiring attention for good condition..... .....

(2nd and following pages)

Name of Railway
Inspection Report, Superstructure of Steel Bridges.
Bridge No.....

Committee on Iron and Steel Structures Discussion

Chairman Dalstrom: The first subject is "Revision of the Manual."

[Mr. Dalstrom then explained the need for the revisions offered and moved their adoption. The motion was carried.]

Mr. Dalstrom: Rules for Field Inspection of Existing Bridges is covered in Appendix C. This is submitted as information. This report has been under preparation for about two years and while the committee believes that it is in reasonably complete form, it is submitted at this time as information with a view to having it appear in the proceedings and inviting discussion so that at the end of this year it can be prepared for including in the Manual next year.

President Ray: This is an interesting subject and we will be glad to have discussion on it if any of you desire. It does not want to be overlooked that during this year the committee will want your written comments on these instructions.

[This and other reports of the committee were received as information and without discussion the committee was excused with the thanks of the association.]

American Railway Engineering Association Registration

THE REGISTRATION of members and guests of the American Railway Engineering Association yesterday totaled 663, including 541 members and 122 guests.

Abbott, R. B., asst. gen. supt., Reading Co., Reading, Pa.
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Armstrong, H. J., assoc. prof. civil egr., Armour Institute, Chicago.
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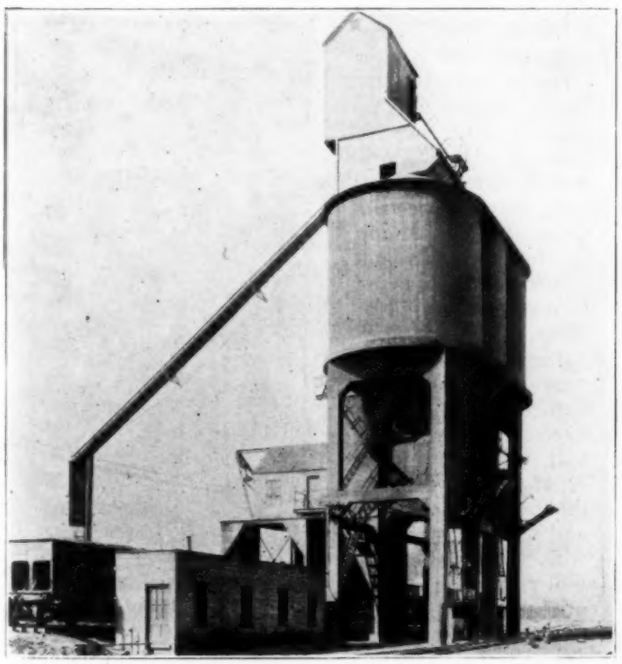
Menard, J. P. div. engr. C. N. R., Quebec, Que.
Mentor Weinstein. Congress.
Mercier, George, assistant supervisor track, B. & A., Boston, Mass.
Midkiff, W. E., roadmaster, Southern, Alexandria, Va.
Miller, H. E., first vice-president, Goodwin Car & Manufacturing Co., Chicago.
Morgan, S. H., roadmaster, Southern, Knoxville, Tenn.
Munson, M. M., inspector water service, M. P., Kansas City, Mo.
Nelson M. A., supervisor, N. C. & St. L., Dickson, Tenn.
Nelson, W. O., maintenance inspector, B. & O., Pittsburgh, Pa.
Nolte. C. B., vice-president and general manager, Robert W. Hunt Co., Chicago.
Oliphant, L. R., supervisor, N. C. & St. L., Marietta, Ga.
Patton, R. C., supervisor, C. & O., Hinton, W. Va.
Pfiefer, Lloyd, contractor, Chicago.
Piesch, Henry, assistant engineer, U. P., Omaha, Neb.
Pinschmidt, W. C., assistant engineer, C. & O., Richmond, Va.
Pruett W. C., district engineer, M. K. T., Waco, Texas.
Reeves, W. T., Robert W. Hunt Co., Chicago.
Reilly, Albert, assistant signal engineer, Hoboken, N. J.
Reiser, L. J., assistant supervisor, T. & T. Dept., C. R. I. & P., Kansas City, Mo.
Rinehart, E., district bridge inspector, B. & O., Baltimore, Md.
Robinson, H. H., supervisor of masonry, Maine Central, Portland, Maine.
Routenberg, H. W., assistant division engineer, B. & O., Baltimore, Md.
Rush, D. B., Robert W. Hunt Co., Chicago.
Ryan, J. M., district engr., N. C. & St. L., Nashville, Tenn.
Sackett, H. S., cons. tim. engr., 231 So. LaSalle St., Chicago.
Scharnagel. A. R., Long-Bell Lumber Co. Shreveport, La.
Scully, J. P., roadmaster, Maine Central, Lewiston, Maine.
Seward, R. R., The Rail Joint Co., New York.

Shoro, Clarence, B. & A., Boston, Mass.
Sparks, W. H., inspector track, C. & O., Russell, Ky.
Stimmel, R. M., C. & O., Huntington, W. Va.
Strachan, G. M., assistant engineer, A. T. & S. F., Chicago.
Stuart, J. C., Robert W. Hunt Co., Chicago.
Swanson, L. C., supervisor, B. & O., Akron, O.
Taylor, W. F., B. & O., Fairmont, W. Va.
Taylor, W. S., C. & O., Covington, Ky.
Teller, Chas. B., roadmaster, C. R. I. & P. Ry., Kansas City, Mo.
Thompson, H. T., Differential Steel Car Co., Findlay, O.
Tinnon, John B., manager, rail welding dept., Metal & Thermit Corp., New York.
Vicholson, J. O., M. P., Van Buren, Ark.
Waters, W. V., supervisor, C. of G., Millen, Ga.
Webb, W. E., supt., C. & O., Huntington, W. Va.
Weedon, R. E., superintendent roadway shops, Southern, Washington, D. C.
Wetstein, Mentor.
Whippe, W. J., Gen. Insp. Track, C. & O., Richmond, Va.
Widener, J. C., chief engineer, Lake Erie Mining Co., Chicago.
Wigglesworth, E. L., general supervisor of painting, C. & O., Richmond, Va.
Wiltse, D. E., master carpenter, Pennsylvania, Sunbury, Pa.
Wood, Galen, chemist, Reading Co., Port Reading, N. J.
Young, A. H., signal engr., Reading, Philadelphia, Pa.
Young, E. C., supervisor, Pennsylvania, Cape Charles, Va.
Zebeth, H. E., foreman, coal and water dept., Procter, Minn.
Zentmyer, C. H., asst. div. engr., C. & O., Clifton Forge, Va.

Sanding Plant Requires Neither Shoveling Nor Air

AT Macon, Ga., on the Central of Georgia, a combined coaling station and sanding plant has been completed which does not require the usual hand shoveling or the use of compressed air for the storage, drying and delivery of sand to locomotives. The facility is a concrete structure composed of three cylindrical bins

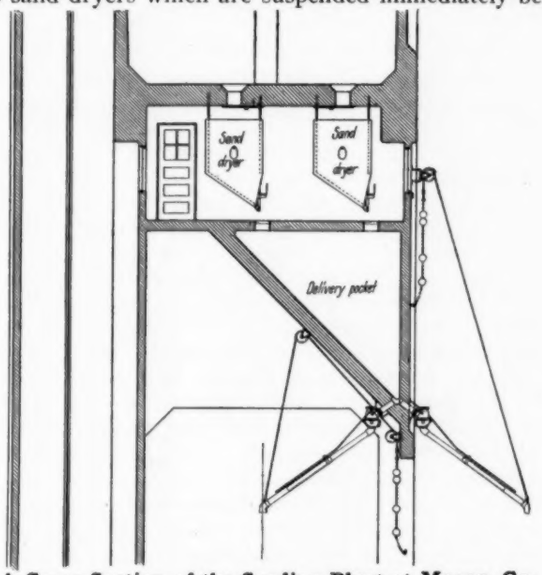


The Central of Georgia's New Coaling Station and Sanding Plant at Macon, Ga.

of reinforced concrete carried on reinforced concrete columns directly above one track and alongside a second track to which coal and sand is delivered by gravity.

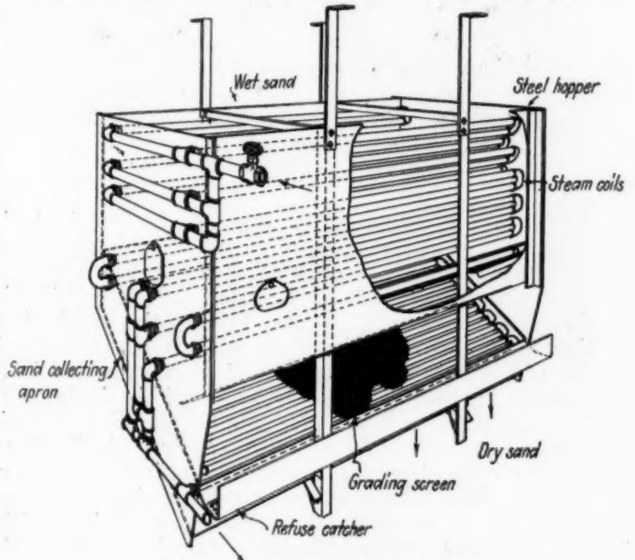
The center cylinder in this plant is devoted entirely to the storage of sand, the bin holding 150 tons. The wet sand is stored in this bin by utilizing the balanced bucket type elevator with which the coal is handled, the process simply being to spot the cars of sand over the coal pit and from there to elevate it to a point above the top of the bin where a deflecting gate directs the discharge into the proper compartment.

The moisture from this sand is removed by means of two sand dryers which are suspended immediately below



A Cross Section of the Sanding Plant at Macon, Ga.

the floor of this bin in a concrete walled compartment especially constructed for housing them. These dryers are a new development for such purposes. They comprise a rectangular steel box about 8 ft. 6 in. long and 4 ft. wide with a sloping bottom in which are carried steam coils. These coils are arranged in the form of a hopper with such a spacing of the pipes as will suffice to hold the sand until it is partially dried and at the same time to interpose such an obstruction to the passage of sand as will serve to break up any cakes that result from the heating. The position of this hopper in the box is also such that the outward radiation from the coils is utilized as well as the inward radiation, there being several inches of space between the coils and the sides of the box, where the sand also accumulates. Below these coils is



A View of the New Sand Dryer

a sloping screen carried on steam pipes several inches above the bottom of the steel box which is also sloping. Here all sand passing through the first steam coils is retained until it is thoroughly dry and all foreign matter

is removed which would otherwise pass down into the locomotive delivery system. The slope of this screen is such as to discharge the refuse into a trough at the side where its removal from the plant requires occasional shoveling out by the plant operator. The bottom of this trough is also perforated to allow the escape of any sand which finds its way to this trough with the refuse. The dry sand itself, after dropping through the screen, strikes the bottom of the steel box which is sloped sufficiently to discharge the sand into a sand delivery bin from which it is delivered by gravity to locomotives through the usual sanding spout.

This arrangement dispenses with the usual hand shoveling required where sand is dried and stored for locomotive use and also dispenses with the requirement of pneumatic air for delivering the sand to locomotives. Each of the sand dryers has a capacity of about one cubic yard per hour, the two dryers at Macon handling 3,000 lb. of sand per hour. No trouble has been encountered in maintaining a gravity flow of the wet sand through the floor of the storage bin into the sand dryer and in all other respects the sanding plant is reported to be operating satisfactorily. A feature which is claimed to enlarge upon its attractiveness is in the ability to use exhaust steam for drying purposes instead of steam generated especially for the purpose. This type of dryer is an invention of the Ogle Construction Company, Chicago, by whom the coaling station was built.

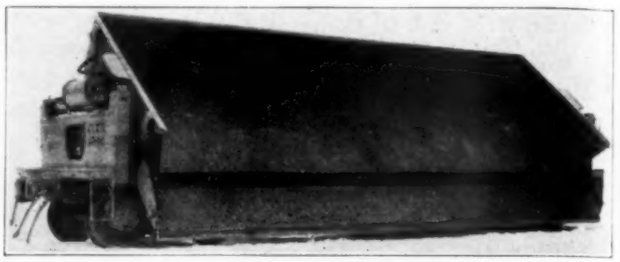
A Heavy Duty Extension Side Dump Car

THE economies in railway operation made possible by cars built to stand up under heavy loadings have not been confined to revenue freight, but extend to work equipment as well. Realizing this fact the Clark Car Company, Pittsburgh, Pa., has developed an all-steel air-operated side dump car of extra heavy design for steam shovel service. This car embodies in

The Clark All-Steel Dump Car

the main the operating features of the standard side dump car as designed by this company, including the extended door, which serves as an extension to the car floor when in the full dumped position, thus delivering the load clear of the tracks. As with the standard car they are operated by air, allowing some of the cars to be dumped in one direction while others are dumped in the opposite direction. The movement of the body to the dumping position is a rolling motion, avoiding excessive shocks, and the body is automatically locked when it returns to the upright position. The body of the new car has extra heavy longitudinal center and side sills, an all-steel floor ¾ in. thick, and a new type of door with a triangular box section, and with extra heavy side stakes and top chord angles. The effective slope angle of the door in the full dumped position has been increased to approximately 51 deg. to assist in unloading sticky material. The capacity of this car is 30 cu. yd., loaded level, or 43 cu. yd. with normal heaping of the load, and it can be furnished in either 50 or 75 tons capacity.

A number of these cars have been placed in service in heavy work where steam shovels ranging from five to eight cubic yards capacity are employed and it is reported



The Car in the Dumping Position

that they are standing up in a satisfactory manner.

The rugged design and simplicity of operation of these cars make the cost of upkeep low, and since they are built to conform to A. R. A. rules and in compliance with the safety appliance requirements of the Interstate Commerce Commission, they are available for general service when not in use as work equipment.

A Lantern Battery for Railroad Use

THE National Carbon Co., Cleveland, Ohio, has redesigned its No. 409-C battery, in order to increase its life and reliability.

The carton of the new battery has a varnished surface printed with the characteristic red, gray and blue color design recently adopted by the company. The terminal contacts pass through a heavy cardboard cover so arranged as to force the accurate positioning of the terminals and to prevent their being bent or twisted out of place. At the terminal end, the battery is provided with a cover flap which passes over the terminals and tucks in at the front. This protects them from breakage, and prevents contact with metal shelving, tool boxes, etc., which might otherwise short circuit and destroy the battery. When the battery is put into service this cover flap is torn off.

New Columbia Battery for Electric Hand Lantern

The internal construction of the battery has also been improved, eliminating the use of the old wooden spacing plug which not infrequently came loose and fell out of place. Also, the unyielding brass connecting strips between cells have been replaced by flexible wire connectors which can withstand vibration and rough handling without tearing loose. The battery also has an opening in the bottom which serves as a storage space for an extra lamp bulb or two.